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AVICENNA AND ARABIAN MEDICINE.

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In considering the life of Avicenna, who has been quite worthily given the Arabian title of "the Prince of Physicians" (el Sheik el Reis), it would certainly not be amiss to enter a little upon the interesting history of that period, and so place ourselves thoroughly in the times when Avicenna lived and taught.

The Arabic period in medicine may be embraced between the years 640 to 1400 A. D.; for about a century previous to the beginning of this, medical science had been slowly degenerating from the wonderful times of Galen and the other celebrated Greek physicians. The nations of the earth were much upset by war and internal troubles, the Roman Empire had been gradually decaying, so with the impetus following the foundation of the strong Eastern Empire under the famous Haroun al Raschid, the Arabians, as well as the Persians, Syrians, Christians and Jews all took prominent parts in an active regeneration of the arts and sciences. The great interest, firm support, protection, fostering care and enrichment, given by the Moslem rulers to either foreign or domestic celebrities, contributed greatly to this advancement.

Many Grecian and other nationalities flocked to the Eastern cities, or to Spain, where the Moors were already shedding light on the learning of the West. The great universities, at Bagdad, Bokhara, Damascus, Alexandria, and other places were founded, and the annual budget allowed to the many universities during some years amounted to over fifty millions of dollars, a very large sum for that period. At Bagdad there were often 6000 teachers and students from all parts of the world. In Spain the cities of Cordova, Toledo, Seville and Murcia possessed great public libraries and academies; the famous university of Cordova in the tenth century having a library of about 250,000 volumes.

The Arabic education of the time was not at all limited, but embraced most of the faculties, so that physicians were often mathematicians, deep philosophers, jurists, theologians and natural scientists. The close intercourse in commerce with the Grecians and the presence of many of their doctors among the early Arabians, paved the way for the foundation of Greco-Arabian medicine, based on the principles and theories of Hippocrates, but especially of Galen: these, however, were not the only influences, as Indian medical views as well as those of the earlier Asiatic people and Egyptians, together with some astrology and alchemy, all entered into the make-up of Arabian medical thought.

As a rule the medical branches were subsidiary to the study of theology, philosophy, mathematics, physics, astronomy, and were not taught separately: "Practical anatomy was excluded utterly by religious belief, and midwifery and gynæcology were then (as almost universally in the East to-day) forbidden to men. The practice of operative surgery, too, was

considered unworthy of a man of honor, and was permitted only to the despised lithotomists and persons of the lower class. Operations performed by the hands, such as venesection, cauterizations and incision of arteries were suitable for physicians' assistants only."

Personal observation was little cultivated though there was some clinical instruction. Rhazes says "a thousand physicians for probably a thousand years have labored on the improvement of medicine; he who reads their writings with assiduity and reflection discovers in a short life more than if he should run after the sick a thousand years"; yet later he confesses very truly, "reading does not make the physician, but a critical judgment and the application of known truths to special cases."

Students after a medical course passed through special examinations before a board before getting their diplomas. The teachers as a rule were well paid, some receiving over 200 dollars a month; this was most important as the medical fees of those days were small, except among the most famous men. The following schedule of fees is rather interesting:

A. The poor must be treated gratuitously.

B. The physician must visit his patient at least twice each day, and if requested by the latter, once also at night. For this he received for every day of treatment:

(a) In the city or at his residence—half a tarenus=$0.14.

(b) Away from his residence, when

(1) The patient paid his travelling expenses—3 tareni = $0.85.

(2) The doctor paid his travelling expenses—4 tareni = $1.17.

The fee was usually stipulated in advance or during the course of the disease, as one writer says: "make it high (the fee) as, after recovery, recollection of the services rendered declines rapidly."

In the tenth century there were in Bagdad as many as 860 physicians, the compounding of whose remedies was most interesting, as almost universally in those days the doctrine of geometrical proportions and musical harmony were employed, thus:

Cardamon is	1°	warm	½°	cold	½°	moist	1°	dry.
Sugar "	2°	"	1°	"	1°	"	2°	"
Indigo "	½°	"	1°	"	½°	"	1°	"
Emblica "	1°	"	2°	"	1°	"	2°	"
Sum "	4½°	"	4½°	"	3°	"	6°	"

As the warm and the cold are equal and the dry twice as much as the moist, the above prescription gives us a compound dry in the first degree.

As regards the hospitals of those times, among the most famous was that at Cairo, as it had both male and female nurses, special wards for wounds, diseases of the eye, diarrhœal diseases, and fevers (this ward being cooled by fountains), a ward for women, one for convalescents, and many other rooms.

Among the most noted of the Arabian physicians were Rhazes (850 to 923), famous for his Liber Continens, with its wonderful description of small-pox and measles. Ali Abbas, who flourished about the same time, and said so aptly that "the physician should control the accuracy of the pictures of disease found in books, by his own careful bedside observations." Albucases (936 to 1013), a Spanish Arabian physician; Avenzoar (1113 to 1162); and Averröes (1166 to 1198) his pupil, whose book we have here to-night written as a compendium of Avicenna's celebrated "Canticum."

The most famous of all these and one whose name and fame lived longer, was Avicenna (the Latinized contraction of his Arabic name, Abû Ali el Hosein, Ibu-Abdallah Ibn-Sina), who was born A. D. 980 at Afschena, a hamlet in the district of Bokhara; his mother being a native of the place, but his father a Persian official, who was able to give him full freedom in his education. He showed such wonderful progress in his work that he is said to have mastered the whole Koran at the age of ten years. After studying various branches of the day, as grammar, dialectics, astronomy and geometry, he learned Indian figures from a travelling merchant, and soon mastered more than his teachers; he spent some time at Aristotelian philosophy, and finally studied medicine at Bagdad, where at the age of 16 he qualified to teach and practice medicine.

His first appointment was that of physician to the Emir, whom he cured of a serious sickness and was rewarded by access to the Royal Library, which he found of great help. Among his earliest works was the Collectio, or a short synopsis of general knowledge. Having lost his father at the age of 22 Avicenna began some years of wandering about the various towns, living under the patronage of the different Emirs, practicing his art, working on his various books, and beginning his famous "Canon." Finally he settled at Hamadâu, where for medical services to the Emir he was made Vizier. Later, however, he was banished, but restored again to power, after a period of seclusion, which was a most profitable time for his writings and studies.

During the last ten years of his life he lived at Ispahan, continuing his work but at the same time leading a life of great excesses. Gradually his once robust constitution was so undermined that he was seized with his fatal illness (a colic) while on the way to Hamadâu with the Emir's army. Finding the disease gaining ground he resigned himself to death, and in his remorse, freed his slaves, gave his wealth to the poor, and listened to the reading of the Koran. He died in June, A. D. 1037, in his 58th year, and was buried at Hamadâu, where, according to M. Schlimmer (Leclerc Vol. I.) the tomb still exists, but has fallen to ruins.

Among the most important works of Avicenna is the Canon, an early edition of which was published in Padua in 1476, but the most complete one in Rome in 1593, this latter in Arabic. Many other editions followed even as late as 1658. This famous work was the text-book for most of the nations for many centuries, and in fact up to 1650 it was still used in the universities of Louvain and Montpellier. This may be noted in the following schedule of studies from the medical curriculum of the University of Leipsic, about the fifteenth century, according to Haeser (Baas).

Hour.	1st Year.	2d Year.	3d Year.
6–7 a. m.	1st Canon of Avicenna with explanation of Jacob of Forti.	The "Ars Parva" of Galen with the exposition of Torrigiano.	The Aphorisms of Hippocrates with the commentaries of Galen and Jacobus.
1 p. m.	Book No. 9 of Rhazes with the exposition of Arculanus.	1st fen. 4th book of the Canon of Avicenna.	4th fen. 1st book of the Canon of Avicenna with the commentaries of Dinus de Garbo, or Hygo.
3 p. m.	The "Doctores" read some work aloud in the semester, as the "Prognosticon of Hippocrates."		

The Canon was divided into five parts: science in general, materia medica, special diseases, common diseases of the different regions and organs, and lastly a general pharmacopeia. We may in looking more thoroughly into this work be struck not only with the wide range of the work, but the practical importance of many of the things found therein, and their application to modern ideas. In etiology and pathogenesis of disease air and water are considered to be important factors; he says "the body to be in a healthy state must have the heart warm, the brain moist, the nerves cold, and the bones dry." He speaks of the predisposition to disease in certain individuals. In the description of a disease of the bone "Spina Ventosa" he notes that it is due to the acrid humor of the bones, but later has a remarkable statement that the "bone may be eaten away by some small animalculus, which enters through a wound and destroys the bone," though he says "this observation is not confirmed" (this might be quite applicable to the modern microbic theory of disease).

Under diagnosis and symptomatology his description of small-pox is quite clear and explicit, a careful description of the rash, whether discrete or confluent being given. Under measles he notes that when the color of the rash is red it is not nearly so fatal as when black (hæmorrhagic form). The fevers are considered under the general heading "epidemic fevers," and their general aspect is well described, especially as regards the appearance of the patient, the pulse, the urine, and the stools. He gives prominent place to mental diseases, describes tetanus, rabies, both in animals and man; three forms of chest inflammation, and also muscular rheumatism. According to Lichtenstein, he is said to be the first physician to teach the contagiousness of phthisis. He distinguishes fifteen kinds of pain, assumes the four peripathetico-scholastic causes of diseases (material, efficient, formal, and final causes), and preserves the Galenical, humoral pathology.

Under the heading of "Prognostics" Avicenna gives a great number of signs and symptoms indicating a favorable termination or not, which resemble somewhat the Hippocratic writings. The following may be quoted:

"The involuntary flowing of tears, especially when from one eye only is a bad sign."

"The eyes remaining open as in a state of watchfulness, even when the finger approaches them, is a sign of death."

"The running of a yellow fluid from the nose in acute fevers is probably a bad sign, and announces the approach of death."

"The deviation of the lips in grave fevers is a bad sign."

"The rejection of water through the nose is a bad sign."

"If the sick one lies upon his stomach contrary to his usual custom it is a bad sign."

"The swelling of the abdomen in acute diseases with diarrhœa, is a sign of death, especially if there appear livid spots."

"Extreme pain in the abdomen with intense fever is serious."

"If you see the sick one make movements with his hands, as if picking things off himself, it is a sign of death."

"If the pain over any organ ceases suddenly without any cause, this disappearance is to be feared."

"The excessive talking of one usually silent indicates the beginning of delirium."

"If the sick one has an exaggerated fear of death it is a bad sign."

"The loss of appetite in chronic diseases, and if thirst ceases in intense fevers; these are very bad signs, especially if the tongue is black."

A large part of the Canon is devoted to the various kinds and forms of treatment of diseases, together with descriptions of the different drugs and compounds so common in those times. The life and habits of the people are considered care-

fully; how the houses should be placed, the water supply and ventilation; the action and uses of exercise and massage are spoken of and the latter is said to be of great use when used judiciously.

Under "Hydrotherapy" hot and cold baths are discussed, and the times for their use noted. Mineral waters are of great use, and certain points as the following may be quoted:

"Sulphur water is good for leprosy, for inflammation of the joints and against the itch."

"Waters charged with alum are good for bloody sputum."

"Sulphur waters are good for disorders of the spleen and liver, and for the pains that accompany it."

"Iron waters are also good for the spleen and stomach."

"Saline waters produce diarrhœa first; then constipation follows."

"All mineral waters render micturition, menstruation and labor difficult."

"In case of snake bite sea water baths are useful."

In the treatment of epidemic fevers Avicenna advocates rest and purgation first, thus seeking to drive out the cause of the disease; bleeding may also be resorted to. He gives his patients pastilles of camphor and cooling syrups, their food and drink should be acidulated with a little sour milk or vinegar. Cold water in large quantities is most useful and profitable. For the bites of mad dogs he advises the use of the cautery or bleeding, saying "all bites are less dangerous the more blood has been lost." As regards drugs he mentions camphor, amber, cubebs, and is especially noted for the introduction of some of the purgatives; manna, senna, rhubarb, tamarind and cassia: also for musk, nutmeg and cloves. Iron in its various forms he used, and considered gold and silver as blood purifiers, hence gilded or silver pills are most effective. He recommends bleeding at the outset of disease, at a point remote from the seat of the disease; but at the end of the illness at a point contiguous to the seat of the disease. In diarrhœa he gave gentle laxatives. In great coldness or in great heat he gave no medicine; considers the same medicine good in one locality, which would be injurious if employed in another.

In surgery he calls the extraction of a cataract a dangerous operation; declines to operate on strangulated hernias, and describes puncture of the bladder. He loosens teeth by means of the fat of tree toads in preference to pulling them. In obstetrics he follows the older writers, and in military surgery the methods of Galen. Baas says "his views (Avicenna) as to what is allowable to a physician are characteristic of Arabian thought and ideas; as a priest he could never employ reason; as a philosopher, however, he could, when, e. g., it is asserted that jaundice is removed on looking at yellow objects, he will not as a physician question the facts, but as a philosopher he cautions against superstitious remedies."

Next to the Canon his most important medical work is an abridgement of medicine in verse called the Canticum (this is the book we have before us to-night, with commentaries on it by Averröes, which was published in 1484 in Venice). Other medical works by Avicenna were those on the Pulse, A Compendium of Medicine, on Chicory, Principles of Therapeutics, and on Colic. Besides these he wrote many important philosophical treatises and works. It is most interesting that Avicenna, who was such an authority among both Arabians and Christians, and whose works had so many commentaries by many writers, was himself mainly a commentator and compiler.

According to Baas

Arabian medicine, entirely independent of its introduction into nosology of a few new and important diseases, rendered itself of essential service to medicine in the following directions:

I. "It cultivated the study of the Greeks, and made them accessible to the West until through the revival of learning, the Greek writers could once more be studied in the original. This transfer of Grecian science including medicine, to the West, was accomplished through Italy and Spain, and even as early as the age of Charlemagne, though it became more marked in the following centuries. By it the Arabians acquired very high importance in the intellectual development of the West, and particularly in its medical culture. Hence the popular scorn of the Arabians, manifested by those who proclaim only 'new facts as acquisitions in medicine,' seems entirely out of place. Indirectly Arabian civilization and culture was of further advantage in that it awakened by its own too servile imitation an opposition against its teachers and even against itself."

II. "It introduced a great number of new and active remedies in the vegetable kingdom, especially from the department of chemistry (a science which it fairly created) and brought to life the pharmacies as an advance in practice."

III. "It contributed directly to the reform of practical medicine by the exhibition of chemical remedies: indirectly by the union of the natural sciences with medicine, which (on the advice of Aristotle) had its origin with them."

IV. "It first entered upon the clinical method of instruction, though it reaped very little advantage therefrom."

V. "It preserved a lay medicine at a time when, as in the West, priests and monks only, in Christian ignorance, treated the sick with superstitious remedies; a period which without the Arabians would have lasted longer than it actually did."

Such are the services which secured to the Arabians for all times an honorable position in the history of medical culture, starting as it did "in the sterile wastes of the desert, here the Arabians constructed a verdant oasis of science, in lands, today once more the home of absolute or partial barbarism. A genuine meteor of civilization were these Arabians, a meteor which arose from the long darkened Orient, and in its course towards the West, lightened the whole Occident before its final extinction."

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THE KERN-PLASMA RELATION THEORY.[1]

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When invited to address you on some aspect of the newer cytology, I chose the kern-plasma relation theory, because it treats of the branch of the subject with which I happen to be most familiar, and for the additional reason that it seems to me to be the one which must exert a most important influence upon our knowledge of the physiology and pathology of the cell.

It will serve to emphasize, also, two facts which we are apt to forget, namely, that pathology is physiology under altered environments and that both physiology and pathology are but branches of General Biology.

Intimately associated with and supplementing the kern-plasma relation theory are Schaudinn's doctrine of nuclear duality (the separation of nuclear material into germinative and somatic nuclear substances) and Goldschmidt's doctrine of the chromidial apparatus. In the following pages I shall quote freely from the writings and teachings of Richard Hertwig, Schaudinn and Richard Goldschmidt, to whom I wish to make due acknowledgment.

The kern-plasma relation theory and the chromidial apparatus theory, which are two of the most important and productive theories of modern zoology, are both products of the Munich Zoological Institute.

It was observed, long since, that cells with a large amount of protoplasm have larger nuclei than those poorer in protoplasm, and further, that certain active cells, such as germinative and secreting cells, have larger nuclei than relatively inactive cells, such as epidermal cells and connective tissue corpuscles.

It remained, however, for Hertwig to investigate these phenomena experimentally and to call attention to the fact that the proportion of the nuclear material to the protoplasm of a cell may not rise or fall beyond certain limits without serious consequences, which are both complex and varied.

As the result of his studies, Hertwig (1903) formulated his kern-plasma relation theory, according to which, "for each cell there exists a definite size relation of nuclear mass to cell mass which may be represented by the formula K/P." According to his view, variations in the kern-plasma relation depend especially upon the assimilation capacity of the cell and upon cell division; hence, functional and divisional growth of the nucleus may be distinguished. His studies on protozoa have convinced him that the kern-plasma relation underlies not only periodic modifications brought about by the ordinary processes of life, but that it may experience more lasting changes under three influences; namely, uninterrupted function, starvation and change of temperature.

Before considering the experimental and other evidence which Hertwig and his pupils have brought forward in support of this theory, it is necessary to review briefly Hertwig's conception of the organization of the nucleus and its relation to the protoplasm.

The basis of the nucleus is the achromatic material arranged, like that of the protoplasm, in the form of a meshwork, in the spaces of which is the nuclear sap. The two important nuclear substances in both protozoan and metazoan cells are the nucleolar substance and the chromatin. The nucleolar substance, which is identical with the plastin of other writers, forms the substratum to which the chromatin is bound and by which it is organized. The chromatin may be uniformly distributed over the nucleolar substance or in thickened masses at various points. In some nuclei there is an excess of nucleolar substance uncombined with chromatin, forming the true nucleoli or plasmosomes of certain protozoan and metazoan cells which are typified especially by the nucleoli of secreting cells. The so-called nucleoli of ganglion cells, then, are not true nucleoli but amphinucleoli (or according to the usual terminology, karyosomes). The true nucleolus or plasmosome does not stain with chromatin-staining dyes and contains no visible chromatin.

There is constant interchange between nucleus and protoplasm. The latter possesses the property of splitting up materials which are taken up and used by the nucleus, while the nucleus continually gives off substances to the protoplasm. As long as the balance of the interchange is in favor of the nucleus, its integrity is assured. That nucleolar substance, both alone and united with chromatin, leaves the nucleus and establishes itself in the protoplasm under a variety of conditions and under various influences is now a well attested fact. To these bodies derived from the nucleus and lying in the protoplasm of various cells a number of names have been given and various functions assigned. As will be shown later, these masses of extranuclear nucleolar substance and chromatin are often concerned actively in the functions of the cell and are, therefore, a part of the nuclear apparatus (chromidial apparatus of Goldschmidt), and sometimes they represent nuclear material in the process of disintegration and extrusion. In either case they play an important part in the kern-plasma relation. These masses of nuclear material (nucleolar substance and chromatin) lying in the protoplasm have been called chromidia and chromidialnetz by Hertwig and chromidial apparatus by Goldschmidt. We must trace the development of our knowledge of these structures before treating of the variations of the kern-plasma relation.

Chromidialnetz.—In 1899, Hertwig described in the protoplasm of the shelled rhizopod *Arcella vulgaris* a net-work of chromatin-staining material situated chiefly at the periphery of the cell. Arcella has usually two nuclei, each containing a central amphinucleolus or karyosome. The protoplasmic chromatic meshwork of Arcella is connected with the nuclei and

[1] Delivered by invitation before the Johns Hopkins Hospital Medical Society, March 16, 1908.

has the staining reactions of the amphinucleus. Hertwig called this structure chromidialnetz. It has all the properties of active nuclear material and may organize itself into definite morphological nuclei. Similar structures have been found by Hertwig in mononuclear Monothalmia.

In the light of Bütschli's work on bacteria and cyanophyceæ Hertwig (1902) is of the opinion that in these organisms the nucleus is lacking as a definite cell organ, but that their protoplasm is beset with a chromidial-net. When the latter is equally distributed throughout the cell, no true cortical layer is visible (a similar condition occurs in encysting *Arcella vulgaris*), but when the chromidial-net is retracted the protoplasm comes into view.

Schaudinn (1902 and 1903), in his remarkable work on *B. bütschlii* and *B. sporonema*, has described the protoplasm of these organisms as having an alveolar meshwork, on the nodal points of which there are granules with the staining reactions of chromatin, the whole having the appearance of a chromidial-net. In both of these bacilli, this scattered chromatin-staining material is gathered before division and spore formation into one or more morphological nuclei. No doubt the remarkable variations in the distribution of the chromatin in *B. diphtheriæ* and similar bacilli will occur to you in this connection.

Chromidia.—In another type of rhizopod, the heliozoan *Actinosphærium eichorni*, a multinucleated organism with numerous pseudopodia and a widely meshed protoplasm, Hertwig (1902) has described the presence of larger and smaller masses of chromatic material in the protoplasm. These masses, consisting of nucleolar substance combined with chromatin and having all the reactions of the amphinucleus, he called chromidia. He traced the origin of these chromidia to the nuclei.

Chromidia may be present in small numbers in normal Actinosphæria and are greatly increased by overfeeding and hunger. Chromidia have been described in various other rhizopods by Schaudinn and by Calkins and in certain gregarines by Léger, Schellach, Kutschakewitsch and others.

Under certain circumstances all of the nuclei of some protozoa, of which Actinosphærium and certain gregarines are examples, may be dissolved and all the nuclear material may be represented by chromidia.

Chromidial apparatus.—Goldschmidt (1904, a and b) has called attention to the important rôle played by chromidia in protozoa, in egg and in various other metazoan cells. He groups as chromidial apparatus not only the chromidial-net and the chromidia of Hertwig, but the nebenkerne, pseudochromosomes, mitochondria, ergastoplasma, trophospongia and apparato reticulare, etc., described by various authors in metazoan cells, and emphasizes their importance in the function of the cell. He worked especially with *Ascaris lumbricoides* and showed that in this animal with huge cells, in addition to the chromatin of the relatively small nuclei, the protoplasm of many cells is beset with larger and smaller strands and irregular masses of chromatin-staining material, which are most abundant about the nuclei and which evidently pass out from the latter. These chromidia are most abundant in Ascaris in epithelial-muscle cells, intestinal cells and body muscle cells; they are also present in certain nerve cells. Goldschmidt regards these chromidia as necessary for the active function of the cells and proved by experiment that they are increased in number and size by increased function.

The development of our knowledge of these variously named chromatin-staining structures in the protoplasm of metazoan cells forms one of the most interesting chapters in modern cytology. As early as 1880, Gaule described chromatin-staining fibrils in the blood corpuscles, pancreas and liver cells of frogs. He called them at first cytozoen, but later identified them with nebenkerne, a name given by Nussbaum (187?-79) to fibrillar structures found by him in pancreas cells of amphibians and corresponding to similar structures found in spermatids and the dotterkerne of eggs.

These nebenkerne have been regarded as nuclear derivatives and important in cell activity by Ogata (1883), Eberth and Müller (1892), Mathews (1899), Montgomery and others. Perhaps the most interesting and comprehensive work of the earlier authors on the extranuclear chromatin-staining material of secreting cells is that of Mathews, who described them in liver and pancreas cells as staining like chromatin, consisting apparently of nucleo-albumin, and derived directly from the nuclear chromatin. They disappear with the elaboration of secretion material and the zymogen granules are formed directly from them.

As mitochondria, Benda described certain granular bodies present near the nuclei in the protoplasm of sperm cells, egg cells and certain epithelia. The pseudochromosomes, central capsules and archo-plasma fibres of Hermann have been grouped by M. Heidenhaim with the mitochromidia. Holmgren (1899 and 1900) has described as trophospongia certain structures which he looked upon as canals in ganglion, pancreas, intestinal epithelium and other cells. Many of these structures described by Holmgren are probably chromidia, though the existence of canals in ganglion cells can not be denied. The apparato reticulare found by Golgi in ganglion cells impregnated with chrome silver is a zonular meshwork of fibrils about the nuclei. Similar structures have been found in cartilage and in various gland cells, and have been identified by certain observers with mitochondria.

Garnier (189?) and Bouin (1898) are responsible for the ergastoplasma doctrine, the essence of which is that there exists a cytoplasm of higher value or power than ordinary cytoplasm; it is supposed to consist of cytochromatin derived from the nucleus. Various authors have assigned to this "superior protoplasm" an important rôle in secreting, muscle, ganglion and germ cells.

Popoff (190?, a), in his work on the sex cells of *Paludina vivipara*, has described chromidia in larger and smaller numbers in the various stages of development of egg and sperm cells and has traced their origin from the nucleus.

Goldschmidt and Popoff (190?, b) have drawn attention to the fact that in both protozoa (Euglina, various amœbæ, Actinosphærium, etc.) and in metazoan sex cells (Paludina, Helix,

etc.) during division, chromidia are thrown from the nucleus. For them, this is connected with the nuclear dualism of cells, which will be discussed later.

That certain bacterial cells have a chromidial apparatus is supported by Hertwig's interpretation of Bütschli's observations and by Schaudinn's work on *B. bütschlii* and *B. sporonema*.

From the foregoing, it is evident that one must recognize under the term nucleus, both intra- and extra-nuclear functioning nuclear material, to which the term nuclear apparatus applies; and that the extra-nuclear material—the chromidial apparatus—is often of great importance to the cell.

NON-DIVISIONAL INCREASE OF NUCLEAR MATERIAL AND ITS CONSEQUENCES.

As previously stated, Hertwig (1903 and 1904) has shown that the kern-plasma relation is disturbed not only just before division, but especially in protozoa and egg cells by (1) overfeeding (increased function), (2) hunger and (3) cold.

(1) By continuous overfeeding of protozoa the increased functional activity of the cells leads to a marked increase of the nuclear material at the expense of the protoplasm. Under these conditions the animals increase both in size and number for a certain period, when they become "depressed," and then recover and feed and multiply for a time, and, then, again suffer a period of "depression."

During the periods of multiplication, the amount of nuclear material is enormously increased and this reaches its highest point when "depression" ensues. The animals become depressed because the balance between nucleus and protoplasm is upset and the power of the cells to regulate this balance is lost. During the periods of depression the cells reconstruct themselves, sometimes by throwing off and destroying nuclear material and sometimes by conjugation.

These facts have been established by Hertwig and his pupils by experiments on *Actinosphærium eichorni*, *Dileptus gigas*, *Paramæcium caudatum* and *Frontonia*. For the latter two organisms accurate measurements of the size of the nucleus and protoplasm have been made (Popoff, 1907, b).

Popoff (1907, b) has shown that in Paramæcium the conjugation epidemics occur during the stage of depression. He overfed a culture of Paramæcium from April 1 until July 16, when the culture died out. He traced the curve of depression and multiplication and found that the greatest disturbance in the kern-plasma relation occurred in depression, when the macronuclei were greatly increased in size, and threw off larger and smaller portions of nuclear material into the protoplasm, which showed actual shrinkage—from 320-360 micra extreme normal to 200-90 micra. Nuclear material separated off from the macronuclei and disappeared. During the depression periods the micronuclei divide and, instead of the normal number, two, there may be as many as eight. This is to be regarded as an evidence of preparation for conjugation.

Hertwig's (1904) observations on the physiological degeneration of *Actinosphærium eichorni* furnish the first and most remarkable evidences of the results of hyperfunction of cells due to overfeeding.

He overfed cultures of *Actinosphærium eichorni* for months. There occurred periods of active growth and multiplication, alternating with intervals of arrest of these as well as of feeding. In the periods of depression, during which the animals lost the power to feed and to multiply, they often lost their pseudopodia and showed various other evidences of illness. Animals killed at various periods of the culture and stained showed marked changes in both nuclei and protoplasm. In this multinucleated organism, with a widely meshed protoplasm, the latter was often thickened and all distinction between the medulla and cortex disappeared. There was hypertrophy and hyperplasia, often associated with hyperchromatism, of the nuclei. The nuclei increased from the normal diameter of from 10 to 14 micra to 20 to 35 or even to 195 micra. The latter he calls giant nuclei and animals with giant nuclei always died; in these the kern-plasma relation is disturbed to a degree incompatible with life.

Hertwig has described in these animals depressed from prolonged overfeeding, besides the changes above mentioned, the outpouring of nucleolar substance and chromatin from the nuclei into the plasma (chromidiosis), the extrusion, the dissolution and the breaking down of the same into pigment, which is in turn extruded, the extrusion of nuclei, the necrosis and shrinkage of protoplasm, the degeneration, as well as various modifications in the size, number and structure of nuclei. Chromidia occur in small amount in normal Actinosphæria, but in these depressed animals they are very numerous and often in large, round, elongated or triangular masses, which are often vacuolated. The pigment is one of the products of the disintegration of these masses, and is thrown off from the surface of the organism. It is of a yellowish-brown color and, as Rössle has shown, it has the same micro-chemical characters as the iron-free pigment of certain metazoan cells. One of the forms of nuclear degeneration described by Hertwig is the vacuolization of nucleoli. Following the dissolution of the nuclear membrane, vacuolated nucleoli may be set free in the protoplasm, where they may assume bizarre shapes.

In the study of a series of Actinosphæria taken from Hertwig's overfed culture last winter and spring, in addition to confirming many of his observations, I (1908) was able to add three new points, namely, the occurrence of pigment granules in nuclei, hyaline degeneration of the nuclear reticulum leading to the formation of shrunken vacuolated nuclei, resembling in some respects the free vacuolated nucleoli of Hertwig (1904), and finally, that in animals with hypertrophied, hyperchromatic nuclei, reduction of the nuclear mass is accomplished mainly by extrusion of chromidia, while in animals with great numbers of relatively small nuclei this is effected chiefly by shrinking, vacuolization, hyaline degeneration and dissolution of nuclei.

The chromidia of Actinosphærium can be traced readily to the nucleoli of the nuclei, with which in many instances a direct connection may be traced and they, therefore, have the same composition as the amphi-nucleoli or karyosomes,

namely, nucleolar substance and chromatin. When they break down, with the formation of yellowish-brown pigment granules, the chromatin as well as the nucleolar substance disappears. Hertwig draws a sharp distinction between the chromidial-net of the Monothalmia and the chromidia of Actinosphærium. The latter represents superabundant nuclear material destined to be destroyed or got rid of while the former is actively functioning extra-nuclear nuclear material from which secondary nuclei may be organized. The chromidia of Actinosphærium do not form new nuclei. The periods of recovery from depression, as shown by resumption of feeding and multiplication, are preceded and marked by efforts to reduce the amount of nuclear material and the changes above outlined indicate the methods used for this purpose. It is interesting to note that these are physiological methods, for, previous to encysting, Actinosphærium reduces the number of its nuclei by from 90 to 95 per cent and by very much the same methods of nuclear destruction.

We can, therefore, agree with Hertwig that, in these animals depressed from increased functional activity, the kern-plasma relation is markedly upset, and it is clearly proven that recovery or regeneration is marked by partial or total return to the normal size-relation between protoplasm and nuclear material. This is accomplished largely by the breaking down and throwing out of redundant nuclear material and, thus, the normal balance between nuclear material and protoplasm is restored. The protoplasm exerts to a remarkable degree its property of breaking down nuclear material.

(2) Hertwig (1903) and his pupils have shown that for certain protozoa (Actinosphærium, Dileptus, Paramæcium) the nuclear material is increased and the protoplasm is diminished in amount during hunger. In starved cultures of Paramæcium, Kasanozeff found that, after division, their bodies are reduced in size when compared with fed Paramæcium and that the macronuclei, on the other hand, are not only relatively but actually larger.

(3) *Changes of temperature.*—Hertwig (1903 and 1906) has shown that when frog's eggs are exposed to low temperatures the nuclei increase in size and further that this may be concerned in sex determination, for when frog's eggs are developed in cold temperatures, the proportion of males is greater than occurs at ordinary temperatures.

H. Marcus (1906) has studied the influence of cold on the kern-plasma relation with interesting and conclusive results. He developed the fertilized eggs of *Strongylocentratus lividus* at 9° C., 19° C., and 22° C., and found that in the blastula stage the nuclei of those bred in the cold were distinctly larger than in those kept at the higher temperatures.

Functional increase of the nuclear material with chromidiosis occurs, as has been pointed out, in sex, gland, ganglion and muscle cells, and it will repay us to review at this point briefly these conditions in sex and secreting cells.

Sex cells.—Hertwig sees in the fact that egg cells, which, as is well known, have very large nuclei, cast off nuclear material into the protoplasm to form the yolk, and, in many species, further reduce their nuclear material by the ripening divisions, another support for the kern-plasma relation theory. Popoff (1907) has recently shown that in the developing egg cells of Paludina and *Helix pomatia*, at certain stages of division, chromidia are extruded from the nuclei.

Secreting cells.—There are three characteristics of gland cells which bear upon our theme—the variations in size and structure of the nucleus, the occurrence in the cytoplasm of bodies which have the reactions of chromatin and nucleolar substance, and the relation of some of the bodies to the so-called "secretion granules." According to Garnier (1900), during secretion, the gland cell nucleus may increase five times in size, and the nucleoli also are increased in volume, while the nuclear chromatin diffuses in the nuclear sap and passes to the protoplasm and forms chromatin clouds, or to the basal filaments.

The presence in the protoplasm of the gland cells of chromatin-staining material, as already mentioned, has been described by a number of authors under the names of nebenkerne, basal filaments, ergastoplasma fibrils, mitochondria, chromidial apparatus, etc. These masses of nucleolar substance and chromatin, staining with basic dyes, occur sometimes as an alveolar meshwork, sometimes as parallel rods, or as irregularly branched fibrils running usually in the long axis of the cell. In some cells, notably the pancreas cells, they may occur as large coils of fibrils, with a homogeneous centre. These lie near the nucleus and represent the nebenkerne of Ogata, Nussbaum and others.

Whatever the names given by various authors to these bodies may be, most of them agree in certain particulars; namely, they stain with chromatin dyes and are intimately connected with the nuclei; often they are continuous with the nuclear membrane, and sometimes they are continuous with the nuclear chromatin. Usually, they are most abundant and conspicuous in resting cells and gradually diminish in size or even disappear during secretion. Another set of bodies are the plasmosomes (composed of nucleolar substance in Hertwig's sense) of Ogata which in the pancreas cells and certain mucous cells make their way from the nucleus into the protoplasm. Launoy (1903) has described in secreting cells division of the nucleolus with the breaking up of this body into fine, vacuolated particles, which pass into the protoplasm and gradually become secretion granules. During rest, the extra-nuclear portion of the nuclear apparatus, then, is rebuilt and during secretion (active function), this material is used up and the nucleus enlarges and shows evidences of hyperactivity. The nuclear material may go out into the protoplasm as karyosomes (nucleolar substance plus chromatin) or as plasmosomes (nucleolar substance minus chromatin). To discuss the further relation of the nuclear materials to the formation of the interesting organoids or secretion granules would lead us too far afield. Suffice it for the present purpose, to call attention to the fact that in actively functioning gland cells, the kern-plasma relation is disturbed, due to the growth of the nucleus and of the chromidial apparatus, and that this activity of the cell is marked by an increase in both production and consumption of nuclear material.

DIVISIONAL INCREASE OF NUCLEAR MATERIAL, AND THE RELATION OF "DEPRESSION" TO CONJUGATION OF CELLS AND THEIR CONNECTION WITH THE KERN-PLASMA RELATION.

Besides the self-regulation and reconstruction of cells, as evidenced by their power to reduce superabundant nuclear material by throwing off chromidia (as in overfed Actinosphæria and in egg cells), and by the using up of nuclear materials by gland cells during secretion, Hertwig has shown that the same effects may be reached by division. It is a common observation that before division the nucleus increases in size, and this, of course, produces an upset in the normal kern-plasma relation. Hertwig and his pupils have demonstrated that when cells are submitted to conditions which increase the amount of nuclear material (as overfeeding, starving, change of temperature) they divide. Overfed protozoa divide rapidly up to a certain point. The marked increase of nuclear material brought about in egg cells by fertilization is followed by the rapid divisions of the segmentation process.

According to Hartwig's (1903) conception, under normal conditions the nucleus and the protoplasm are in a state of equilibrium or tension, which may be upset, in various ways, to a degree sufficient to lead to division; sometimes nutrition, sometimes starvation, and at other times other factors may upset the equilibrium and act upon the unknown factor governing division.

In the segmenting egg, with the enormous disproportion between nucleus and protoplasm, and in which the divisions follow each other in such rapid succession, outside agents, such as food, may be disregarded. When the divisions cease, they are not resumed without the action of a fresh stimulus from without, as food for instance, which would change the equilibrium again and be followed by renewed divisions.

In support of his contention that when the proportion of nucleus and protoplasm passes beyond a certain degree, division will not occur until the protoplasm increases in amount, Hertwig quotes the observation of Gerosimoff on the alga Spirogyra, in which, when submitted to cold, on division, one division product may contain no nucleus and the other two nuclei, or one nucleus of double size; the latter cell cannot divide until its protoplasm has increased to a very great degree. Then, on division very large fibrils with large nuclei are produced. He holds that the division process is governed by two factors: (1) the protoplasm has and may use its power of splitting up nuclear elements, and (2) the nucleus has a sufficient capacity to assimilate products from the protoplasm. Arrest of division will occur when one or both of these conditions are not fulfilled.

Our knowledge of the life conditions of cells has been greatly furthered by the studies of Maupas, Calkins, Hertwig and Popoff upon "depressed" protozoa, which have exploded Weissmann's doctrine of the immortality of the protozoa.

These observations have been made chiefly upon infusoria, cultivated in the laboratory for long periods of time. The organisms will thrive and multiply for a number of generations and then die out. During the culture the organisms show alternate waves of rapid increase and of cessation of division. In the periods of cessation of division or periods of depression, as proved by the studies of Hertwig and his pupils, the organisms are characterized by a marked upset in the kern-plasma relation. The nuclear material, in Paramæcium and Actinosphærium, for instance, is very much increased, and, unless the cells can reorganize themselves, they die out. As previously pointed out, this may be done by dissolution, degeneration and extrusion of nuclei, by chromidiosis, and by the action of certain salts (Calkins) and, in the infusoria, by conjugation. In Paramæcium, for instance, the epidemics of conjugation coincide with the periods of depression; and conjugation, with the incident divisions and fusions of micronuclei, and the degeneration of the old and the formation of new macronuclei, is the natural and most effective method of recovery from depression, and causes a rejuvenescence of the cells, through the reconstruction and restoration of the kern-plasma relation which takes place. Hertwig regards this as the most important provision for prevention of physiological degeneration and of the extinction of the species. In metazoa, this is accomplished through the union of the sex cells, while the somatic cells, debarred from this, must ultimately perish from physiological degeneration—the cause of physiological death.

NUCLEAR DIMORPHISM AND NUCLEAR DUALITY.

A discussion of the kern-plasma relation theory cannot be complete without a consideration of these two factors.

Many of the infusoria, for instance, possess two nuclei—a macronucleus, which is large, and apparently governs the metabolism of the cell, and a micronucleus, which, as its name implies, is small, and which shows no special signs of activity except during division and conjugation, when it actively multiplies. The former contains evidently the somatic nuclear material and governs the ordinary cell activities, while the latter is distinctly a germinative nucleus, and in it reside the divisional and constructive activities of the cell. At conjugation, in Paramæcium, for instance, there is active division of the micronuclei in the conjugating pair, and daughter micronuclei from each animal pass to the other and conjugate. The nuclei resulting from this conjugation divide and form not only the micronuclei, but the new macronuclei as well, the old macronuclei having degenerated and been cast off. The macronuclei have been likened to the chromidial apparatus of certain protozoan and egg cells, and the micronuclei to the nuclei of ripe sex cells.

As is well known, there is a great variability in the arrangement of the nuclear material, especially in the lowest vegetable and animal cells, and, in many forms, the arrangement may be changed at different periods of activity and development. In the vegatative stage, the nuclear material of bacteria is "diffused"—in certain forms, as in *B. bütschlii* and *B. sporonema* (Schaudinn), as granules (chromidial-net of Hertwig) at the nodal points of the protoplasmic meshwork; while, at division and spore formation, it collects into a mass with the appearance and behavior of a morphological nucleus. In 1894, Schaudinn described in *Calcituba polymorpha*, the formation

of definite morphological nuclei from diffused chromatin. In some protozoa, the nuclear material may be in small scattered masses, while in others, in addition to these, there are larger masses resembling morphological nuclei, but without nuclear membranes or differentiation of the nuclear structures, such as the lining meshwork. Above these, come fully developed morphological nuclei after the type of those found in metazoan cells. In many cases, both among protozoa and egg cells, associated with these morphological nuclei, there is a more or less well defined chromidial apparatus. Here we meet with another type of nuclear dimorphism. In some cases, as in egg cells and in certain protozoa, as Actinosphærium, *Noctiluca miliaris*, etc., during division, the chromidial apparatus represents somatic chromatin. In other cases it is clear that new nuclei may be formed from it, as from the chromidial-net of *Arcella vulgaris*. In studying nucleus formation in certain rhizopods, Schaudinn (1903) observed that the chromidial masses in the protoplasm were divided germinative nuclei.

Léger (1904) found, in the gregarine Stylorhynchus, that, in the division leading to sporoblast formation, two kinds of nuclei appear: the germinative and the somatic. The former give rise to the nuclei of the sex cells and the latter to numerous somatic fragments.

Kuschakewitsch (1907) has recently studied two gregarines which, especially in the protomerit, have a well marked chromidial apparatus. During sporulation, the nuclei seek the periphery of the cyst, and there resolve into a fine chromidial net-work which later condenses with the formation of new nuclei which divide.

Schaudinn and Von Prowazek (1904) regard the nucleus of a resting trypanosome or herpetamonas as two nuclei bound in one. In the development of the ookinete into the trypanosome this double nucleus separates into two—one becoming the germinative or sexual nucleus, and the other the nucleus of motility or blepharoplast, from which the motor apparatus is developed. As Goldschmidt has pointed out, these two nuclei, the one propagatory, the other somatic, having the same number of chromosomes and the same ripening processes, are comparable to the micro- and macronuclei of the infusoria.

This doctrine of nuclear duality, founded by Schaudinn and elaborated by Goldschmidt (1904) and Goldschmidt and Popoff (1907), is, it is readily seen, intimately connected both with Hertwig's kern-plasma relation doctrine and the chromidial doctrine. Goldschmidt's conclusions may be condensed as follows:

(1) Each animal cell is doubly nucleated, containing a somatic and a propagatory nucleus. The first controls the somatic functions, as metabolism and motion, the second contains the hereditary substances and has the property of forming a new somatic nucleus.

(2) The two nuclear types are usually united in one nucleus —the amphinucleus. Separation may occur to a greater or less degree; usually, at most, into a predominantly propagatory or mixed nucleus—the cell nucleus in the ordinary sense and the chief mass of the somatic nucleus or chromidial apparatus.

(3) Complete separation may occur—as in the propagation of protozoa and in oogenesis and spermatogenesis.

(4) In tissue cells the separation may be recognizable. In the nuclei of egg cells two kinds of chromatin are to be distinguished, idio-chromatin and tropho-chromatin. The separation is evident when a part of the somatic nucleus is in the plasma as chromidial apparatus, as occurs in gland cells and in egg cells during yolk formation. A nearly complete separation may occur in ganglion and certain muscle cells, in which the somatic nucleus is represented by chromidial apparatus, which, of course, is built and replenished by the propagatory nucleus.

(5) Cells with only a propagatory nucleus, which can, however, reform the somatic nucleus, are represented by the gametes of protozoa and nurse cells of the ovary and possibly also by certain spermatozoa.

(6) Cells with only somatic nuclei are represented by the "rest bodies" of gregarines and the "diminished" cells of Ascaris and certain muscle cells.

For Goldschmidt a well developed chromidial apparatus denotes active function or capacity for function, and serves to bring an increased amount of somatic or metabolic nuclear substance into more intimate relation with the protoplasm than is possible when the whole of such material is collected within the nucleus.

Lately Goldschmidt and Popoff (1907) have found additional support for the chromidial apparatus doctrine in comparing the spongy centrosome of Actinosphærium, the sphere of *Noctiluca miliaris* and the chromidia extruded from nuclei in the ova cysts in Paludina and in *Helix pomatia*, in all of which at the beginning of division chromatic particles pass out of one pole of the nucleus and lie in the protoplasm. They regard these masses as chromidial apparatus (as Hertwig had previously done) and as representing somatic nuclear material, while the nucleus represents the propagatory nuclear substance.

General Biological Considerations Suggested by the Kern-plasma Relation Theory.

In the foregoing pages I have traced the leading theories of the Munich School of Zoology—those of the kern-plasma relation, the chromidial apparatus and nuclear duality—at some length, and have, I hope, indicated some of the numerous lights they throw upon the biology of the cell. I have also endeavored to make clear the fact that these theories, while separate and distinct from each other, are also closely interwoven.

The essence of the kern-plasma relation theory is that for each cell there is a definite size relation between nucleus (nuclear material) and protoplasm which may not be upset beyond certain physiological limits without serious consequences, and that in each cell there is not only a normal mass relation between nuclear material and protoplasm, but the protoplasm possesses powers to preserve a normal equilibrium between the two. A cell is normal only so long as this balance is preserved within proper limits. In growing cells, the bal-

ance is struck by growth of protoplasm; in older cells, by the casting out of nuclear material into the protoplasm—chromidiosis—where it is destroyed and thrown off and by dissolution and degeneration of nuclei. The chief causes of the upset of the kern-plasma relation are increased function, starvation, change of temperature, fertilization (in egg cells) and the group of other conditions which lead to division. In these states the nucleus takes up an increased amount of material from the protoplasm.

Increased function, whether brought about by overfeeding or by various other stimuli, such as those that act upon gland, muscle and ganglion cells, causes hypertrophy and hyperplasia of the nuclei of protozoa and of many metazoan cells. In the protozoa, this increase of nuclear material is reduced to the normal relation to the protoplasm most readily, perhaps, by division; when this fails chromidiosis and dissolution and extrusion of nuclear material are called into play. If these means are not sufficient, the cells go into a state of depression from which they can often recover only by conjugation, a process in which not only regulation and reconstruction, but nuclear reduction, are prominent. The protoplasm has not only the power of using up nuclear material in function, but of breaking it down when it is present in excessive amount.

In gland, muscle and ganglion cells, usually, the excessive nuclear material is used up in functional activity, but I may venture the suggestion that this is not always the case, for witness the evidence of nuclear reduction by chromidiosis furnished by the frequent occurrence of pigment in muscle and ganglion cells, and the fact that gland cells are constantly being worn out and replaced.

Did gland, muscle and ganglion cells not possess these natural means of reducing functional increase of nuclear materials, they would have but two alternatives; to die from giant nucleus formation or to divide. It is evident that in these cells the balance is nicely adjusted and, in this adjustment, muscle and ganglion cells in the higher animals have lost their divisional nuclear material. The latter is preserved in gland cells, however, for in most glands the cells cannot only divide to repair losses from various causes, but when the stimulus is increased, glandular organs (the thyroid for instance) may undergo hyperplasia with marked divisional activity of the gland cells. In an interesting and suggestive work on the life history of the thymus cells, H. Marcus has traced in these cells periods of depression associated with upset of the kern-plasma relation which lead often to various degenerations of both nucleus and protoplasm and follow rapidly repeated divisions. He has also found that the thymus cell with disarranged kern-plasma relation may regulate itself and approach the normal by reducing its nuclear material by means of chromidiosis.

This self-regulation of functioning cells cannot go on forever, however, for all organisms, both protozoa (as Maupas, Calkins and Hertwig have shown, contrary to Wiessmann's theory that protozoa are immortal) and metazoa die sooner or later. This physiological degeneration of cells, as Hertwig has pointed out, is due to their lack of the power of permanent self-regulation and proper reconstruction of the kern-plasma relation. In protozoa, it may be overcome by conjugation, but in metazoa this is possible only for the sex cells, the only metazoan cells capable of continuous proliferation. A possible exception here is furnished by the cells of certain transplantable tumors of rodents, and those of malignant tumors of man and the higher animals, and here the possibility of fertilization must be borne in mind. In fact, Farmer, Moore and Walker have claimed the demonstration of heterotypical mitoses in certain tumor cells.

When the functional activity of cells causes a continual increase of nuclear material beyond a certain limit, the cell goes into "depression," from which it may or may not be able to extricate itself by the exertion on the part of the protoplasm of its power to destroy nuclear material or by conjugation. In an organism like Actinosphærium, for instance, in which conjugation is isogamous, conjugation in "depression" is often impossible because the protoplasm cannot break down nuclear material sufficiently for cyst formation to occur, or, if encystment takes place, the cells in the cyst are too abnormal for conjugation, as Hertwig has shown.

There is considerable room for confusion between functionally active somatic chromidia of protozoa and of gland, muscle, ganglion and other tissue cells, true chromidial apparatus, and the generative chromidia on the one hand and the chromidia signifying reduction of nuclear material on the other. But a sharp distinction between these three types of chromidia is essential. Goldschmidt includes the chromidia of depressed protozoa, dividing protozoa and egg cells with the chromidia of functioning tissue cells as functioning chromidia under the term chromidial apparatus. Hertwig disagrees with this view and regards the chromidia of depressed and dividing cells as useless, nonfunctioning nuclear material, to be got rid of in the effort of the cells to regulate their kern-plasma relation.

In my opinion, the balance of evidence is in favor of Hertwig's position. It seems to me best to reserve the term chromidial apparatus for evidently functionally or divisionally active chromidia. Perhaps the best examples of functionally active chromidia are furnished by certain muscle, ganglion and gland cells. In these cells, although the nucleus increases in size during function, it of itself does not supply sufficient nuclear material for such large and active cells; therefore, extra-nuclear nuclear material is necessary to raise the kern-plasma relation balance, as well as to bring the nuclear material into closer relation with the protoplasm.

There is no doubt that many bodies in reality representing degeneration of nucleoli and of plasmosomes or examples of chromidiosis have been confounded by pathologists with parasites.

In conclusion it may be suggested that the chief problems of cellular pathology upon which light may be shed by these theories are the autochthonous pigmentations, the hypertrophies and the hyperplasias and their fate, the proliferation of cells under the influence of parasites, and lastly, the biology of tumor cells.

The relation of chromidiosis to pigment formation I (1908) have discussed in a recent article. The other subjects are now under investigation by Dr. O. T. Schultz and myself and I will not dwell upon them at the present time, except to call attention to the fact that Hertwig, in his article on the physiological degeneration of *Actinosphærium eichorni*, has recognized the many points of resemblance between the conditions obtaining in this organism in depression and those occurring in the cells of malignant tumors. In both there occur atypical mitoses, hypo- and hyper-chromatism of nuclei, increase in the size of the nuclei and the same types of nuclear degeneration.

NOTE.—Since this was written, two interesting and important articles bearing on the subjects discussed in this paper have appeared. They can be read with profit by all who are interested in the physiology and pathology of the cell. (See H. Marcus, Beiträge zur Kenntniss der Gymnophionen. Ueber das Schundspaltengebiet. Die Thymus, pp. 734-767. Arch. f. mikroskp. Anat. u. Entwicklungsgesch., 1908, Bd. 71; and Theodor Moroff, Die bei den Cephalopoden vorkommenden Aggregataarten als Grundlage einer kritischen Studie über die Physiologie des Zellkerns. Allegemeiner Teil., pp. 148-213. Arch. f. Protistenk., 1908, Bd. XI, Erstes Heft.)

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FRITZ SCHAUDINN.

A REVIEW OF HIS WORK.[1]

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The work of Schaudinn is, perhaps, not very familiar to the reader of medical literature, although the discovery of the syphilis organism gave him considerable prominence even in the minds of those who confine themselves to the reviews of purely medical matters.

Fritz Richard Schaudinn was born on the nineteenth of September, 1871, at Roesiningken, a village of East Prussia. He obtained his degree of Doctor of Philosophy on the third of March, 1894. He died on June the twenty-second, 1906. Into this short life of less than thirty-five years, into a working period of twelve years, there was crowded a wealth of work, which, judged by the standard of quantity alone, must stamp the author as a remarkably indefatigable worker. Judged by the higher standard of quality, his work makes of him a genius, one of those truly wonderful master-minds that appear only once in a long period of time. When he died scientific medical research lost its most brilliant exponent, a man destined by training and ability to carry us far along certain lines of work. Although much progress will undoubtedly be made along the paths marked out by him the fullest possible measure of that progress will not be realized until there shall appear another with the trained technic, the keen observation, and the intellect of Fritz Schaudinn.

Concerning his early education little need be said. He has been dead too short a while for time to have had an opportunity to cast about his life that haze which makes it possible for historians to quarrel as to which teacher or which particular event is of chief importance in determining the mind's development. As a youth he attended the Gymnasium at Insterburg and at Gumbinnen, leaving the latter place in 1890 to enter the University of Berlin. His original intention was to take up the study of philology. His interest was soon transferred, however, to zoölogy, and it was in this latter subject that he obtained his Doctor's degree. His thesis was a description of *Myxotheca arenilega*, a new species and new genus of the Foraminifera. In July, 1894, he went to Bergen, Norway, for the purpose of collecting material, returning to Berlin in October as Assistant in the Zoölogical Institute.

During the year 1894 there appeared a number of papers which mark the beginning of Schaudinn's interest in the variations of the reproductive process among the protozoa. For Calcituba and several other marine Foraminifera he described, as a new type of nuclear multiplication, the loss of the membrane of the adult nucleus, the distribution of the chromatin throughout the cytoplasm, and the formation of multiple daughter nuclei from the scattered chromatin granules. Nine years later Richard Hertwig described a similar phenomenon of chromatin diffusion in *Actinosphærium eichorni* and gave to it the name of chromidium formation. In the case of this latter organism, however, Hertwig showed that the process is associated with certain of the vegetative functions of the cell and not with reproduction. Further work, particularly by Schaudinn, by Hertwig, and by Goldschmidt, established the important rôle that chromidium formation plays in the reproduction and the nutrition of many protozoan cells. In this doctrine, which forms the major part of Hertwig's kern-plasma relation theory, we have a light which must lead us through the darkness that marks the present state of cellular physiology and pathology.

Another of Schaudinn's contributions of 1894 was the description of *Camptonema nutans*, a multi-nucleated rhizopod supplied with radiating pseudopodia. The latter, besides the already well-known movements due to flowing of the plasma, have the power of rotation and of flexion and extension. The axial fiber of each pseudopod passes into the cytoplasm and its inner end becomes attached to a nucleus by a cap-like enlargement. This intimate relationship of external organelle and nucleus Shaudinn believed to be an expression of such a controlling influence of the latter over the former as exists in metazoan spermatozoa. The correctness of this view was proven by his later work upon the development of the locomotory apparatus of *Trypanosoma noctuæ*, and the idea constitutes an important addition to our knowledge of the functions of the nucleus.

In 1894 there appeared, also, the description of multiple division of the shelled amœba, *Hyalopus dujardinii*, with the formation of flagellated young forms. This observation, that an adult protozoan with the organelles characteristic of one class may produce young with the organelles supposed to be specific of an entirely different class, may be considered the beginning of Schaudinn's long series of additions to our knowledge of the protozoan life cycle. The importance of the recognition of the various changes that a protozoon may show in its life history has been justly insisted upon by Calkins. He would make the presentation of the entire cycle of a protozoon the prerequisite for its acceptance as a new species. He demands some ground principle which shall unify the science of protozoölogy. Concerning Schaudinn's part in supplying this principle Calkins says: "It was the genius of Schaudinn to establish such an unifying foundation, and in his clear perception of the importance of the life cycle we have the keynote of our present-day conception of the protozoa." In my attempts to teach to students an outline

[1] Read before the Experimental Medicine Section of the Academy of Medicine of Cleveland, January 10, 1908.

of protozoölogy I, likewise, have been struck by the large share that Schaudinn has had in the advancement of this side of the subject. I have been accustomed to consider the reproduction of the protozoa the most important chapter in protistology. In looking over the notes in which I have tried to summarize the nuclear and morphological variations that make up protozoan life histories I find that the chapter is largely a recapitulation of Schaudinn's work.

Dimorphism of adult organisms has long been known among the Foraminifera. It remained for Schaudinn and Lister, in 1895, independently of each other, to explain the genesis of this condition in *Polystomella crispa*, and to show that the dimorphism is part of a life cycle in which one form, multiplying by flagellospore formation, alternates with the other form, which multiplies by the production of amœbaspores.

Work upon *Amœba crystalligera* in 1894, and the discovery of *Amœba binucleata* in 1895, and of *Paramœba eilhardi* in the following year, resulted in observations upon the finer occurrences in the processes of direct and indirect nuclear division. For Paramœba Schaudinn described a cycle much like that of Hyalopus. The point of chief importance in the former organism is the possession of a nucleus-like body in addition to the true nucleus, both being present in all the stages of the cycle. The true function of this "nebenkoerper" appeared during the division of the flagellospores. During this stage the body acts exactly like a centrosome. Similar conclusions as to the function of the centralkorn of the Heliozoa were arrived at from a study of *Acanthocystis aculeata*, published in 1896. Furthermore, proof of the primary intra-nuclear origin of a centrosome which later becomes permanently extra-nuclear, was furnished. In this respect Acanthyocystis seems to be intermediate between those flagellates possessed of nuclei in which the division material is permanently intra-nuclear and *Paramœba eilhardi* and *Noctiluca milaris*, in which, as in metazoan cells, the centrosome is permanently extra-nuclear. In Acanthocystis there is much the same relationship between the axial fibers of the pseudopodia and the centralkorn as exists between the fibers and the nuclei in Camptonema. The establishment of the kinetic nature of the centralkorn, its control not only of the energy of nuclear division but also of the movements of the external organelles, was confirmed and amplified by later work upon the nature of the blepharoplast of the trypanosomes.

An important fact brought out during the same year in a study of *Actinophrys sol* was the occurrence of fertilization at one stage of the life history by a process intermediate between the partial karyogamy or conjugation of the ciliates and the complete karyogamy or copulation of other forms.

In 1897 Schaudinn, in association with Siedlecki, showed that in certain of the Coccidia there occurs a copulation of sexually differentiated gametes, a process strikingly like the fusion of ovum and spermatazoon. Further results of this work appeared in 1900, when the complete life cycle of *Eimeria schubergi* was published by Schaudinn. This paper is an example of the ideal in research. The array of facts presented indicates the possession of remarkable technical perfection of hands and of eyes, experimental resourcefulness, an intuitive knowledge of what to look for, and the intellect necessary for the proper interpretation of the findings. And above all, the facts are recorded in language that is fascinating.

In 1898 Schaudinn was promoted to Privatdocent in the University of Berlin. The greater part of this year was spent in a collecting trip to the Arctic Ocean. The results of this journey appeared under the combined editorship of Schaudinn and Roemer in a collection entitled "Fauna Arctica," four volumes of which have appeared.

The description of the complete life cycle of the newly-discovered rhizopod, *Trichosphærium sieboldi*, appeared in 1899. So thorough was this piece of work that not a single fact remains to be added to the life history as published by Schaudinn. The cycle of Trichosphærium is not quite so complicated as the coccidian cycle published during the following year, since in the former the copulation is isogamous.

During the same year he was able to report a confirmation of the work of Ross and of Grassi upon the cycle of the malarial parasite, and pointed out the analogies in the life histories of this organism and of the Coccidia.

The extreme biological importance of Schaudinn's observations had become quite evident. The German Government, to whose fostering spirit is due much of the scientific eminence of the Germans, was quick to realize the aid that a man of his training and ability might bring to protozoölogy as applied to medicine. In 1901 he was sent by the Kaiserliche Gesundheitsamt to Rovigno for the purpose of devoting himself more particularly to the pathogenic protozoa. He remained in Rovigno until 1904. This period was marked by the appearance of a number of observations of direct value to medicine. Of these, two very important ones concern the malarial parasite and the intestinal amœbæ. He was able actually to see the entrance into the red corpuscle of the malarial sporozoite, the end stage of the sexual cycle in the mosquito, and of the merozoite, the end stage of the asexual cycle in the human being. Furthermore, he established the fact that the relapse in malaria is due to a peculiar biological modification of the normal cycle of the parasite. He showed that the makrogametocytes, which normally are destined to fertilization in the mosquito's stomach, may remain in the human blood and fail to be fertilized. In the internal organs they reduce their chromatin. Parthenogenetic division results in the establishment of a fresh series of asexual generations, manifested clinically by the relapse.

In 1860 Lambl, and in 1870 Lewis and Cunningham, noted the occurrence of a new species of amœba in the intestinal contents of persons ill with tropical dysentery. This organism was more accurately described by Loesch in 1875 and named *Amœba coli*. For many years there has been considerable controversy between medical men, on the one hand, and biologists, on the other, concerning this protozoon. In amœbic dysentery clinicians saw a fairly well characterized disease. For pathologists, the anatomical findings in this

condition were even more specific. Medical workers became convinced of the etiological relationship of the organism to the disease. The occurrence of an amœba, not to be distinguished from *Amœba coli*, in the intestines of healthy persons caused the biologists to maintain a rather skeptical attitude as to the pathogenicity of *Amœba coli*. For some of them it was only a harmless secondary invader. Others considered it pathogenic, but only after the lesions had been started by bacteria. Before one could state that dysentery is due to an amœba biologists justly demanded morphological differences which would permit one to distinguish between the organism associated with disease and that found in the healthy intestine. It remained for Schaudinn to describe such differences. He showed that in the human intestine there may be present at least two species of amœbæ, very much alike at first glance, but showing marked differences in their modes of reproduction. To the species found only in association with dysentery and its complications he gave the name *Entamœba histolytica*. The other, the one found in the healthy intestine, the one which corresponds more nearly to Loesch's description, he called *Entamœba coli*. There are morphological differences which, now that they have been pointed out, permit us to differentiate the two. Concerning the modes of reproduction, Schaudinn showed that the pathogenic amœba gives rise to a number of small encysted amœbæ whose nuclei are derived from the chromidial network of the parent organism. In the reproduction of *Entamœba coli* a single amœba encysts and two daughter nuclei are formed from the original single nucleus. These undergo reducing divisions, then fuse and fertilize each other. Of the eight daughter amœbæ which are finally formed within the mother cyst each receives a single nucleus produced by the division of the synkaryon.

In the establishment of autogamy among the true fertilization processes we have an hypothesis rich in possibilities for biological research. The work of recent years upon the reproduction of the protozoa, the work of Schaudinn in particular, has completely overthrown whatever last vestige of possibility there may have been in the once famous doctrine of the immortality of the protozoa. Although for many of these unicellular animals no phenomenon of fertilization is known this must be ascribed to a lack of sufficient research, and there does not seem to be any probability that there can be any exception to the general rule that fertilization is necessary for the continued multiplication of every animal cell. In cells of only one kind is there an apparently unlimited proliferation without fertilization. I refer, of course, to the cells of malignant tumors. The gametoid theory of Farmer, Moore, and Walker has not received confirmation, and Bashford and Murray's conjugation of tumor-cell nuclei can be more satisfactorily explained as something else. The continued multiplication of tumor cells without fertilization seems improbable. If fertilization does occur, so primitive a process as autogamy must be borne in mind, and the proof of its occurrence would place one phase of the tumor question upon a firm biological basis.

While at Rovigno Schaudinn published the results of work upon two new species of bacteria. That upon *Bacillus bütschlii*, a parasite of the cockroach's intestine, is extremely important. The organism is characterized by its unusually large size and by the fact that it forms two endogenous spores. In this case, therefore, spore formation is not merely a protective arrangement, but it is also a true reproductive process which results in an increase in the number of individuals. Schaudinn showed that *Bacillus bütschlii* is made up of an alveolar protoplasm, in the interalveolar spaces of which lies a network of granules which are stained by the chromatin dyes. In the division during the vegetative state some of these granules become aggregated at the center of the bacillus, and division occurs through this central mass. In spore formation the greater portion of the granular material becomes collected at each pole into a large mass, which has the morphological characteristics of the nuclei of higher plant and animal cells. Autogamous fertilization then occurs between these two nuclei, followed by the final formation of a spore at each end of the bacillus. Grassi, in 1900, made the statement that the complete life history of not a single bacterium was known. That division could continue indefinitely without a sexual act he considered improbable, and he explained the dying out of certain bacterial epidemics upon the supposition that the conditions necessary for this sexual act were wanting. In view of Schaudinn's work upon *Bacillus bütschlii* in 1902 Grassi's words appear prophetic.

The work upon *Bacillus sporonema* is interesting chiefly because spore formation occurs after an abortive attempt at the ordinary vegetative division. It would seem that sporulation does not happen until the energy necessary for transverse fission is completely dissipated. In a review of Schaudinn's publications upon *Bacillus bütschlii* and *Bacillus sporonema* Mesnil says: "Their importance is very great, at once for the comprehension of the morphology of the Bacteriaceæ, for the general significance of sporulation in the lower organisms, and for the phylogenetic seriation of the phenomena of sexuality."

In 1904 Schaudinn was recalled to Berlin by the Kaiserliche Gesundheitsamt and was made director of the newly-established division for protozoölogy. The first work undertaken after his return was an investigation into the modes of infection in ankylostomiasis, with the object of devising means for the prophylaxis of this disease. Looss had shown that the larvæ of *Ankylostomum duodenale* may enter the body by way of the skin. van Durme had shown the same thing for *Strongyloides intestinalis*. Their views were attacked by the Italian, Piéri. By experiments upon monkeys Schaudinn established beyond controversy that the larvæ of *Ankylostomum duodenale* may penetrate the normal skin and give rise to an intestinal infection.

During 1904 Schaudinn published two further papers, the results of work done while at Rovigno. Of these, one was purely practical in nature, like the Ankylostomum work. By the prophylactic treatment with quinine he freed the village

of St. Michele di Leme, in which malaria was endemic, of this disease.

The other, upon the alternation of generations and of hosts of two of the blood parasites of a species of owl, may be considered the most important of all of Schaudinn's researches. This paper is too rich in valuable ideas to permit of adequate condensation. Only three of the more epoch-making points may be stated.

Firstly, he showed that *Halteridium noctuæ*, a parasite of the red blood corpuscles, and *Trypanosoma noctuæ*, a parasite of the plasma, are portions of a single cycle, the sexual part of which occurs in a mosquito. In other words, he established the intimate relationship of the Hæmosporidia and the Trypanosomidæ, two groups which had previously been widely separated in the zoölogical classification of the protozoa. Of the four classes of the protozoa three were fairly sharply characterized by their external organelles. The members of the remaining class, the Sporozoa, had in common only their obligate parasitism and their reproduction by multiple fission. Recent work has shown that the latter process is not at all limited to the Sporozoa. Schaudinn's work, therefore, was revolutionary. Based upon it and upon the confirmation that it has received Hartmann very recently has proposed a classification from which the Sporozoa, as a class, have been removed, and in which the Hæmosporidia and the Trypanosomata have been united to form a new flagellate order, Binucleata.

Secondly, Schaudinn traced the derivation of the blepharoplast of the trypanosomes from the nucleus by a heteropolar mitosis, and the development of the motor apparatus from the former by a second mitosis.

Thirdly, he established certain points of fundamental importance for our conception of the process of fertilization.

One portion of the owl parasite research illustrates the thoroughness that marks all of Schaudinn's labors. In following out the life cycle it was necessary for him to work with the mosquito. He added a number of new facts relating to the anatomy and physiology of this insect.

In May, 1905, Schaudinn, working in collaboration with Hoffmann, announced the presence of a characteristic spiral organism in certain of the products of syphilis. This organism they called *Spirochæta pallida*. Several other short papers followed in rapid succession, all dealing with syphilis. In these earlier papers it was not claimed that *Spirochæta pallida* is the cause of syphilis. Schaudinn and Hoffman contented themselves with a description of the organism and with statements of the lesions in which it had been found. In two years there has appeared an immense literature dealing with the relationship of *Spirochæta pallida* to syphilis. It is unnecessary here to go into the arguments which favor the etiological relationship of the organism to the disease. They may be summarized in the brief statement that in the minds of competent observers such a relationship has been established. The final solution of the much-discussed question of the etiology of syphilis, important as it was, brought into play only one of the many qualities which made Schaudinn pre-eminent. I refer to his extraordinary training in the use of the microscope, a training which permitted him to see what had for so long entirely escaped numerous investigators.

In a paper published in October, 1905, Schaudinn described the morphological characteristics of several species of spirochætæ. He showed that the outline of a cross-section of the body is flattened because of the presence of an undulating membrane, that there is present a condition of nuclear dualism, and that the body form is flexible rather than fixed. He concluded that the spirochætæ are protozoa and that the genus is closely related to the Trypanosomata. For *Spirochæta pallida* he could not certainly demonstrate an undulating membrane. He stated, further, that the body outline in cross-section appears circular, and that at each end there is a flagellum-like prolongation of the periplast. These characteristics warranted the establishment of a new genus, Treponema, for the syphilis parasite.

In the wealth of material published by Schaudinn up to this period he had confined himself to terse presentations of actual observations. He neglected the theoretical considerations of his work. For this he has been criticised. He was only thirty-five at the time of his death. He was not permitted to live to that Oslerian age when a man may cease active productive work and may properly begin philosophical theorizing. However, on the thirteenth of June, 1905, in a paper entitled "Neuere Forschungen über die Befruchtung bei Protozoen" and presented before the Deutsche Zoölogische Gesellschaft, he did state some of the theoretical conclusions to which his work had led him.

Nuclear dimorphism is the rule among the highly-organized Infusoria. In the members of this class the relationship of the micronucleus to division and to conjugation, and that of the macronucleus to the vegetative functions of the cell have long been known. In the work upon *Trypanosoma noctuæ* Schaudinn had established the origin of the blepharoplast and of the nucleus from a single nucleus. He had shown, also, that the function of the blepharoplast is a kinetic one, controlling the energy of mitosis and the movements of the motor apparatus. He postulates, therefore, that nuclear dualism is a condition common to all protozoa; in some, evidenced by the presence of two distinct nuclei, as in the Infusoria and the Trypanosomata; in others, only by physiological differences at some stage of the life cycle. The possession of nuclear properties, some of which are somatic or vegetative in nature, the remainder reproductive or animal, gives to every protozoan cell two forces which are constantly antagonizing each other. There is a perpetual tendency for one or the other of these forces to become predominant. If the vegetative chromatin gains the upper hand, sexual differentiation into a female cell occurs. If the animal characteristics win out at the expense of those of a somatic nature, differentiation into a male cell results. When sexual differentiation has been produced the antagonism is at its height and will lead to cell death because of the final complete loss of the characteristics of the weaker nature. The death of the cell is inevitable unless there is

produced a balance between the antagonistic nuclear forces. This is accomplished by fertilization, and the result is an indifferent cell in which the warring nuclear properties are approximately balanced and in which the struggle can begin anew. The fertilization, when it occurs, is a double one. The propagatory chromatin of one cell fuses, finally, not only with chromatin of a like nature in the other cell, but also with the somatic chromatin.

The correlation of Schaudinn's views upon nuclear dualism and upon its relationship to fertilization and of Hertwig's kern-plasma relation theory and its bearing upon fertilization need not be attempted at this time. I do not think that they are at all antagonistic. They harmonize with each other and complete each other. If both are borne in mind they form a combination which makes a working hypothesis that ought to yield results in the investigation of a number of problems of interest in pathology and physiology.

Early in 1906 Schaudinn was called to Hamburg by the Institut für Schiffs- und Tropenhygiene to become the head of the division for protozoölogy which he was to organize. Here he continued his work upon syphilis. Several short papers upon this subject were published after the author's death by von Prowazek. From a study of sections treated by the silver nitrate method Schaudinn had become convinced of the etiological relationship of *Treponema pallidum* to syphilis. He also adduced further facts to establish the longitudinal division and the protozoan nature of the parasite.

In the twelve years of his working life Schaudinn saw protozoölogy become a very important branch of zoölogy, and, largely through his own work, saw it add much to general biological knowledge. He saw protozoa study become a science of great value to medicine, not only through the results it has yielded in investigations of the etiology of disease, but also through the help that it offers toward the solution of many general problems. He saw the contributions to the literature of the subject reach such numbers that they demanded a publication devoted to them alone. This journal, the Archiv für Protistenkunde, he founded in 1903.

What would have been the ultimate results of Schaudinn's labors, had he lived to complete them, cannot be imagined until they shall be taken up by another equally gifted. In the development of his own work, his earlier purely biological researches and the transition to the later ones more directly applicable to pathology, is foreshadowed the path which pathological research must take in order to add anything fundamentally new to our knowledge.

THE METHODS OF THE HENRY PHIPPS INSTITUTE FOR THE STUDY, TREATMENT, AND PREVENTION OF TUBERCULOSIS IN PHILADELPHIA.[1]

By JOSEPH WALSH, M. D., Philadelphia.

The invitation to read a paper before the Laennec Society was accompanied by the request that the paper be on the detailed workings of the Henry Phipps Institute. This is therefore my excuse for the paper.

The Phipps Institute was opened on February 1, 1903, for the study, treatment, and prevention of tuberculosis, and the word "study" was designedly put first.

The institute comprises a dispensary and a hospital. The wards of the hospital accommodate only fifty-two cases, eighteen women and thirty-four men. The work was inaugurated with three physicians, the number of whom was gradually increased to thirty-two. These physicians are divided as follows:

A medical director, four laryngologists, a dermatologist, a pathologist, a bacteriologist, a neurologist, an ophthalmologist, a genito-urinary surgeon, and twenty-one clinical physicians.

In both the dispensary and hospital only tuberculous cases are treated, and it is insisted upon that they be destitute. If they are capable of paying a physician even fifty cents a visit they are referred to their home physician.

There are in the present temporary quarters no facilities for treating surgical cases, and hence no attempt is made to treat them. The only operations ever done in the hospital or dispensary have been the opening of an ischio-rectal abscess, the tapping of a pleural effusion, the introduction of a tube for empyema or an urgent tracheotomy.

It happened that the man chosen by Mr. Phipps to be director of the institute was already director of a large sanatorium for the treatment of early cases. In addition to this sanatorium there was already three hospitals for early cases in and about the city of Philadelphia, and it appeared both to Mr. Phipps and Dr. Flick that the most good could be accomplished by a hospital for advanced cases. The hospital was made, therefore, for these cases only.

The good accomplished by a hospital for advanced cases is more in the way of prevention and study than of treatment. The typical suitable patient for the Phipps Institute hospital is a member of a very poor family in an advanced stage of consumption who is not only a burden to the rest of the family on account of the care required, but is also probably infecting other members of the family. A concrete example would be the father of a family in which there were small children. On account of the illness of the head of the house, the wife is obliged to work for the support of the family, and when she

[1] An address delivered before The Laennec, A Society for the Study of Tuberculosis, at the Johns Hopkins Hospital, March 19, 1908.

is at home is obliged to care for the children and the patient. It is almost impossible for an ignorant housewife to thus take proper care of a patient, especially without infecting herself, or without allowing the children to become infected. It is also practically impossible in our day for a woman to get sufficiently remunerative work to support such a household. The removal, therefore, of this case to a hospital removes one person from the support of the worker, removes a patient requiring considerable care from the hands of an ignorant individual already over-worked, and prevents the possibility of further contagion in the household. The patient is kept in the Phipps Institute until he either recovers sufficiently to do a certain amount of work or until he dies.

In order to further the study, before the patient is admitted to the institute his nearest legal relative is obliged to sign a certificate permitting an autopsy in case the patient dies in the hospital.

In the hospital there are no resident physicians. The fifty-two cases are divided up among ten visiting physicians who visit the hospital at least every second day. The hospital has a history record sheet made up by the staff from the comparison of a number of such blanks gathered in from all parts of the world. Each year this blank has been partially changed, corresponding to the experience of the members of the staff. This history sheet, therefore, is as complete as the staff deems necessary to show the physical condition and sociological status of the patient, although it is still changed somewhat every year. It is filled out entirely by the visiting physician, in other words, the history is taken in its entirety by men of experience and not by recent graduates. In addition to this sheet, there is a diagram for the outline of physical signs, which is also filled in by the visiting physician. The staff of physicians meets every Monday evening; and once a month, all the histories in the house and in the dispensary are brought before a history censor committee, and any thing lacking on the sheet or diagram is called to the attention of the staff. By this means every history and diagram is kept absolutely complete in all details. In the histories and diagrams it is necessary to indicate not only the abnormal, but also the normal.

In addition to these histories we have what are called monthly summaries. These monthly summaries repeat a certain number of the questions of the history in regard to things that may have changed since the admission of the patient; as for instance, the cough, expectoration, hæmorrhage, curved nails, curved fingers, enlarged glands, etc., and repeat also the diagram. In other words, while the patient is in the hospital a complete examination in regard to symptoms and physical signs is made once a month. This is taken care of in the same fashion by the censor committee, as the original history.

There is also a complete nose, throat, and ear record sheet for any patient who manifests symptoms pointing to disease of these organs, likewise, a complete nervous sheet which is filled out for every house case and many dispensary cases.

Though the cases in the hospital are divided up among the different physicians and each physician has his own set of cases, there is a special understanding which not only allows but encourages every physician on both the house and dispensary staff to examine any or all the other cases. This examination is voluntary and the physician may or may not make a diagram of it. It is particularly requested, however, that a physician making an examination in this fashion, make a diagram and attach his name to it, so that there may be as many examinations as possible, if the case should come to autopsy. It is very common, therefore, at autopsy to find several complete examinations by the physician who treated the case, and several others by other physicians on the staff. This not only makes the autopsy interesting, but causes it to be done in an exhaustive fashion. Like our history sheets, we have a very complete autopsy sheet, every question on which must be answered.

At the end of the year all the statistics relative to cases are compiled and printed in an annual report.

In the dispensary, as in the hospital only absolutely destitute cases are taken. In regard to the financial condition, the word of the patient is taken for the primary examination and treatment. Subsequent to this, however, an inspectress visits the patient's house and if his financial condition is found better than stated, he is refused further treatment.

The history and examination sheets used in the dispensary are the same as in the hospital, and they are filled out with the same exactness. The summary examinations, however, are required in the dispensary not once a month, but once in three months. We have fifteen men in the dispensary, each one spending four hours a week, seeing altogether an average of seven hundred new cases a year, and four hundred old cases. These dispensary physicians come two days a week, spend two hours each time, and see the different cases once in two weeks. It takes about an hour to see a new case the first time, hence they see only one or at most two new cases on any single day. Cases are seen only once in two weeks in order to give sufficient time for changes of condition to be noticed and in order to avoid too much medical interference, which can do harm. I have always thought that the greatest trick I learned in the treatment of tuberculosis was the infrequent seeing of cases. It is not possible to treat every little symptom manifested by a tuberculous patient, and if the patient is seen frequently it is almost impossible to avoid this overmedication, which only does harm.

As soon as the patient comes into the dispensary, whether he is a new or old case, he is handed a spit cup by a nurse who is always present in charge of the dispensary, and he uses the spit cup while awaiting his turn, and takes it with him into the examining room. These spit cups are the regulation paste board spit cups in a brass container. As each patient is leaving, after his first visit, he is given free of charge a set of preventive rules to hang up in the house, one brass container, fourteen spit cups, and a number of paper handkerchiefs, and paper bags. He is shown exactly how to use these different things by the nurse in charge, and instructed in the necessity for their use by the physician.

If the patient is destitute he is frequently ordered milk by

the physician. We have two milk stations in Philadelphia: one at the institute itself, and one in Kensington, in the northern section of the city, about three miles away from the institute. In addition milk is delivered in the western and southern sections of the city through local milk dealers.

Milk is given to the patient under various circumstances and in varying amounts. The most common intention in giving milk is for the nourishment of the patient in order to make him well, and in this case the milk is usually given in quantities of about three quarts per day; it is given, however, also for the purpose of being able to control an advanced case even when it is evident nothing can be done in the way of cure or improvement. All patients coming to the dispensary are given preventive supplies in the shape of spit cups, and paper napkins; only about one-quarter of them are given milk.

When a patient coming to the dispensary is an early case he is usually advised to go to the White Haven Sanatorium for six months, though if his resistance is very good, or if he refuses to go to the sanatorium on account of not wishing to leave his family without support, he is treated in the dispensary and encouraged to come once in two weeks. The nurse visits his apartments or house and reports on it; if he is living in too confined an apartment, the nurse and physician both advise a change. Sometimes this change is accomplished, again it is found practically impossible on account of lack of funds to meet more rent. In this case as much as possible is done at the present home. The wife, or other members of the family are instructed in the communicability of the disease and the steps required in order to prevent infection. They are advised to keep the children outside as much as possible during the day. It is insisted that the rooms be wide open at night, be disinfected immediately by the Board of Health, and be kept clean, practically disinfected thereafter. The wife is instructed to boil all the eating utensils or to wash the patient's separately. She is instructed to use a wet or moist broom in sweeping, not a dry broom; also a wet cloth in dusting, not a dry cloth. It is seen that the patient has a bed to himself, even though a makeshift in the shape of a couch has to be put up.

The nurse visits the patient once in two weeks and reports on the following: The amount of milk received by the patient from the institute; whether or not it is used by the patient; whether or not he is working; whether or not he takes exercise out of doors; sleeps with the windows open; sits in the kitchen; uses a spit cup; uses his paper napkins; burns spit cups and napkins; spits on sidewalk when on street; uses handkerchiefs or rags; whether or not the premises are clean; whether or not there is a back yard and what its condition; how many people there are in the house; how many windows in the house; whether or not there are other inmates in the house sick; whether or not the patient uses stimulants; if the rules of the institute have been hung up in the house; and whether or not she (the nurse) has instructed the patient in the observance of the rules. There is a special printed blank for these questions which the nurse writes out and joins to the history of the patient so that the physician may see at the next visit of the patient the inspectress' point of view in regard to how the patient is co-operating with him. All the answers to the questions which go to show the patient is doing his duty in that description are written in back ink. The things which the patient does contrary to what he ought to do are written in red ink in order to call the physician's attention to them without being obliged to read the whole report.

If the patient is not following the physician's directions, his attention is called to the fact, and if he is found disobeying the emphasized directions, his milk is stopped, if he gets milk, or his treatment, if he merely gets treatment.

If the patient has advanced tuberculosis he is encouraged to come into the Phipps Institute or go to the Philadelphia General Hospital. Sometimes he refuses to come into the Phipps Institute on account of the autopsy requirement and refuses to go to the Philadelphia Hospital on account of it being also the alms house. Such a case is investigated before there is any question of giving him milk and then only in case he cannot be controlled without the milk is he given a quart of milk daily, and then only in case he can be controlled by it.

Even in the dispensary we look more to prevention than to absolute cure, though we try also to accomplish the latter; in other words even in the dispensary we are not satisfied to hold patients as life long milk pensioners. A patient is treated for a definite length of time, as for instance, six months or a year, being carefully instructed throughout this period. We consider then that if we have not cured him, we have at least instructed him so that he should not be a menace to others. If then he has been getting material aid, this aid is stopped. Of course the patient may continue and usually does continue coming to the dispensary for advice.

In some of the European dispensaries, especially the one at Lille, before the patient is examined, he is sent to a bath room and while he is being bathed his clothes are disinfected. This is an added help in the way of instruction and in addition aids in prevention since the patient's clothes are so likely to be infected.

In addition to milk, the French dispensaries supply eggs, meat, coal and sometimes lodging. It also takes care of all the patient's laundry in order to make sure that it is frequently washed and also in order to avoid the possibility of infecting the laundress.

In addition to the hospital and dispensary the Phipps Institute has an extensive laboratory in which all those connected with the institute, work. The laboratory is fitted up for bacteriological and pathological study. Since it is simply a modern laboratory I omit details.

One of the frequent questions asked us is, how much opposition is manifested towards the autopsy requirements for admission to the hospital. It is surprising to know how little opposition is made to it. There are practically only three classes of people who raise any objection whatsoever; first, the Hebrews, since it is definitely against their belief; second, the Irish who have a great sentimental regard for the dead

bodies of their friends; third, the colored people, who fear that the permission to do the autopsy carries with it the sure death of the individual. The Germans and the English make no objection whatsoever, and the objections of the others are so easily overcome that the majority of our patients are Irish and a few are colored people and Jews.

The good accomplished by the Phipps Institute may be put under three heads: the good to the physicians, the good to the patients, and the good to the public at large, accruing from the study, treatment, and prevention of tuberculosis. In the study of tuberculosis the physician derives his benefit, first from the examination of the case, and particularly from the fact that the examination must be complete, thereby rendering him more thorough in his work; second, from the confirmation or non-confirmation of his examination findings at autopsy; and third, from the weekly staff meetings which average more than twenty men out of the staff of thirty-two, at which cases and theoretical questions are discussed and to which uncommon or difficult cases and pathological specimens are brought.

The benefit to the patients lies in the amount of improvement produced, the care taken of them while they are very ill, and the prevention of contagion in other members of the family.

Since the hospital is intended for advanced cases, and since according to our statistics only advanced cases are admitted, it is readily intelligible that our results would not appeal to a layman on account of the number of patients who die. To physicians, however, this is perfectly natural and from our standpoint what is remarkable is not the number who die because that was to be expected, but the number that not only improve but improve sufficiently to go back to light work for one or more years.

The following are the statistics of the results of treatment of cases in the Phipps Institute that remained in the hospital or came to the dispensary over a period of three months for the year ending February, 1907:

	HOUSE.	DISPENSARY.
Incipient arrested	..	6 (16.22%)
" improved	..	27 (72.97%)
" unimproved	..	4 (10.81%)
" died	..	..
Moderately advanced arrested	..	..
" " improved	6 (50%)	53 (67.09%)
" " unimproved	2 (16.66%)	22 (27.84%)
" " died	4 (33.33%)	4 (5.06%)
Far advanced arrested	..	..
" " improved	18 (41.86%)	7 (35%)
" " unimproved	14 (32.55%)	9 (45%)
" " died	11 (25.58%)	4 (20%)
	55	136

The benefit to the public is in the general prevention of the disease; in the education of physicians to be capable of recognizing the disease in an early stage, and capable of treating it so as to insure cure if cure is possible; in the popular lectures which are given by the various members of the staff on request, either to popular societies, like labor and beneficial unions, or to medical societies; in the education of trained nurses in the care of tuberculosis, and in the running of tuberculosis dispensaries and sanatoria; and in the general diffusion of education by means of the annual report published in an edition of five thousand copies and distributed gratis.

A study of what is being accomplished in the way of the prevention of tuberculosis, published in the Third Annual Report, was entitled "A Statistical Study of the Influence of the Henry Phipps Institute upon the death-rate in Philadelphia." This statistical study was made of all the wards in the city of Philadelphia, and it was found that all the wards in which tuberculosis dispensaries or hospitals were located showed a definite decrease in tuberculosis, which was above the legitimate decrease taking place almost everywhere. The largest decrease in the city of Philadelphia was found in the wards in which the Phipps Institute does the greatest amount of its work, despite the fact that these are the slum wards of the city. The only wards which showed a definite increase in tuberculosis during the past three years were the fashionable wards in which the wealthy people live.

The fact that every ward in which a tuberculosis institution exists has had a reduction in the death-rate from tuberculosis is very interesting in view of the opposition which exists to the establishment of institutions for the treatment of tuberculosis on the score of danger to the neighborhood. There was the strongest opposition to the location of the Rush Hospital in the twenty-fourth ward. The twenty-fourth ward shows a reduction in the death rate from tuberculosis while its neighbor, the thirty-fourth ward, with exactly the same kind of a population, has had an increase.

Another very interesting fact is that the reduction in the death-rate from tuberculosis during the three years is among the poor in the crowded parts of Philadelphia rather than among the well-to-do in the sparsely built up parts of the city. The greatest reduction has been in the slum district, the foreign district, the colored district, and the manufacturing districts. These are just the parts of Philadelphia in which tuberculosis was most rife formerly. The wards in which the wealthy and the well-to-do live either have had an increase in tuberculosis or very little decrease. A corollary springs from these facts that the superficial instruction given to the wealthy and well-to-do for the prevention of tuberculosis as advocated by many is insufficient for the prevention of tuberculosis.

One of the things at the Phipps Institute that we are proudest of and would not be without is our training school of nurses.

When the institute first opened we were forced to take any nurse that we could get, and the majority of these knew little or nothing about the care of the tuberculous. Moreover many of them were afraid of tuberculosis and accepted positions simply because they were out of a position at the time. The inauguration of our own training school was a great venture since we put into it only cured tuberculous cases. Practically all of these tuberculous cases came from the White Haven Sanatorium. We consider our training school a great success and it is a success for probably the following reasons: first,

even when the girls enter they are already pretty well trained in the care of the tuberculous on account of the knowledge received in the cure of their own case; second, having gotten over tuberculosis themselves, they are not at all afraid of it; third, they are not disgusted by the unpleasant features of tuberculosis, namely, the expectoration, etc.; fourth, on account of their own cure, they are extremely enthusiastic about the cure of others, and having seen quite advanced cases recover they are never ready to give up hope; fifth, they are a constant source of encouragement to the patients who have thus constantly before them an example of cured tuberculosis.

The training school has been opened three years. So far we have taken in thirty-five girls of whom eighteen have graduated and have lucrative positions outside. Of the thirty-five, five have broken down.

It is commonly thought that our nurses must have been very early cases of tuberculosis. This is not at all true. The majority of our nurses were moderately advanced cases of tuberculosis. A small number were early cases and a few far advanced. One of the nurses at present in our training school has a cavity at the top of each lung, has moist râles all over both lungs, and was for two years absolutely confined to bed. Another of our nurses came into the Phipps Institute in a far advanced stage and successfully graduated in our training school this fall. I have gone into this question of nurses rather extensively because the most important essential of a tuberculosis dispensary is a well trained nurse.

There are two ways of running a tuberculosis dispensary, namely, like the Phipps Institute dispensary or the German dispensaries. The Phipps Institute dispensary is devoted more to the study and the German dispensary more to the treatment of the cases. The Phipps Institute dispensary treats a small number of patients, the German dispensary a large number. In the Phipps Institute dispensary a physician does everything in connection with a case except visit it; he takes the complete history, makes the complete examination, weighs the financial condition, gives instructions, etc., etc. In the German dispensary the nurse takes the history, judges the financial circumstances, and gives the instructions, the physician deciding only on the diagnosis. I think there are good arguments for both classes of dispensaries. Where the amount of funds is limited I think the arguments favor the Phipps Institute method since the patient is not only treated but the physician is further educated. In the German dispensary there is practically no lack of funds on account of the backing by either the insurance companies or the government.

PROCEEDINGS OF SOCIETIES.

THE JOHNS HOPKINS MEDICAL SOCIETY.

March 2, 1908.

Meeting of the Johns Hopkins Hospital Medical Society, Dr. Finney presiding.

I. A Case of Gas-cyst of the Intestine. DR. FINNEY.

The case was that of a man, between 60 and 70 years of age, who sought surgical advice because of his having lost more than one-half of his weight within a comparatively short time. For the past year he had suffered digestive disturbances that had gradually grown worse. When first seen he was vomiting everything that he ate, and at times the vomitus included food taken 24 or 48 hours previously, showing obstruction at the pylorus. He had vomited blood. Since his gastric juice contained no free hydrochloric acid and because of other symptoms, a diagnosis of carcinoma of the pylorus was made.

To relieve the obstruction a gastro-enterostomy was performed. The operation revealed cancer of the pylorus that involved the upper portion of the duodenum and the lower part of the stomach, as well as the retroperitoneal glands.

Springing from the free border of the ileum, near the ileo-cæcal valve, and fitting collar-like around the intestine for a distance of about 8 inches, was a peculiar soft mass or tumor, which extended up pouch-like from the ileum. This mass was made up of many thousands of little blebs that on cross section looked like bubbles or soapsuds, innumerable bubbles, pressed so closely together that they were facetted. At the base of the tumor along the intestine there was more fibrous tissue than elsewhere. Here and there were rather old hæmorrhages—about a dozen or more. The size of the blebs ranged from that of a small grape to a point just within range of vision.

The picture was more that of an echinococcus cyst than anything else. When cut into it was evident that the cysts contained air under so much tension that they popped. The gas did not burn. There were no bacteria in the cysts, which were lined by endothelium and supported by a delicate fibrous tissue framework. Giant cells, some necrosis, and endarteritis obliterans of the vessels were also to be made out. The giant cells formed in the endothelium.

The literature contains very few references to gas-cysts. Mayer of Bonn, in 1825, reported finding cysts containing nothing but air, in the pig's intestine. Since then these have frequently been observed in healthy pigs. In 1867 Winckel first noted a similar condition in man. Including the case presented by the author there have been in all eight instances of the gas-cyst of the intestine reported as occurring in man, only two of which were noted in the living subject.

DISCUSSION.

DR. WELCH stated that when working with the *B. aerogenes capsulatus* some years ago he became interested in these cysts, but he was left in doubt whether this organism caused the cysts. Gas-cysts of the brain have quite a literature: here they are due to the gas bacillus. He did not think that Dr.

Finney's case could be interpreted as a *B. aerogenes capsulatus* cyst, since microscopic sections showed some very remarkable polyhedral cells with curious honeycombed, vacuolar appearances that seemed characteristic. Mayer, he said, regards these as tumors and the gas as secretion; and there seems a priori at least no reason why we could not imagine cells occurring, which secrete gas. Nevertheless, it is hard to see why the gas remains and is not absorbed.

II. Splenectomy, with a Report of Six Cases. Dr. George Ben Johnston, Richmond, Va.

This paper embraced a statistical summary of all cases of splenectomy, reported prior to 1908; together with an account of six cases operated upon by the author.

Bardeleben's demonstration that the spleen might be removed without appreciable loss to the animal economy led to the operation as indicated in the occurrence of pathological changes, injuries and wounds. Vulpian summed up the changes resultant on splenectomy as follows: (1) a transient decrease in the red blood count and an increase in the white blood count; (2) the thyroid gland cannot assume the function of the spleen; (3) the lymph glands and bone marrow show increased activity; (4) the regeneration of blood is probably less rapid than normal. Some patients complain of pain in the bones, while others show an enlargement of the thyroid.

In his statistical study of splenectomy the speaker tabulated the lesions for which the operation was performed under 13 headings: idiopathic hypertrophy, ectopic spleen, ectopic spleen with twisted pedicle, malarial hypertrophy, ectopic malarial spleen, ectopic malarial spleen with torsion, splenic anæmia (Banti's disease), cysts of the spleen, leukæmia, tuberculosis, sarcoma, abscess, and miscellaneous affections. He divided all cases under three headings: those reported before 1890, those between 1890 and 1900, and those from 1900 to 1908.

(1) Idiopathic hypertrophy.—It is most probable that this condition results from some past infection, latent malaria, syphilis, etc. The indications for removal are usually prophylactic against subsequent possible rupture. The results are: prior to 1890, 18 cases with 11 deaths; 1890 to 1900, 15 cases with 2 deaths; 1900 to 1908, 41 cases with 8 deaths.

(2) Ectopic spleen.—The cause may be congenital (in rare instances), but it is usually an enlargement that produces relaxation of the suspensory ligaments. The indications for removal are, danger of torsion of the pedicle and the subjective symptoms on account of pressure. The results are: prior to 1890, 17 operations with 3 deaths; 1890 to 1900, 28 cases with 2 deaths; 1900 to 1908, 14 cases with 1 death.

(3) Ectopic spleen with torsion of the pedicle.—Operation is imperative. It is usually possible to make out the tense and tender spleen. The results are: prior to 1890, 5 cases with 4 deaths; 1890 to 1900, 11 cases with 4 deaths; 1900 to 1908, 11 cases with no death.

(4) Malarial hypertrophy.—The indications for operation are increased size, increased mobility, the tendency to rupture and danger of torsion of the pedicle, anæmia and cachexia make the prognosis grave. The results are: before 1890, 24 cases with 15 deaths; 1890 to 1900, 64 cases with 15 deaths; 1900 to 1908, 58 cases with 8 deaths.

(5) Ectopic malarial spleen.—The mortality is very low. Before 1890 there were 11 cases with no death; 1890 to 1900, 15 cases with 1 death; 1900-1908, 14 cases with no death.

(6) Ectopic malarial spleen with torsion of the pedicle.—Before 1890, 2 cases with 1 death; 1890 to 1900, 3 cases with 1 death; 1900 to 1908, 7 cases with 1 death.

(7) Splenic anæmia (Banti's disease).—This classification includes those cases of enlargement of the spleen with anæmia and without a history of malaria or general glandular enlargement. Two cases operated upon by Cushing and by Warren are well after 8 and 6½ years respectively. The results are: before 1890, 12 cases with 5 deaths; 1890 to 1900, 18 cases with 4 deaths; 1900 to 1908, 25 cases with 3 deaths.

(8) Cysts.—These may be non-parasitic, hydatid, which are the most common, and dermoid, of which only one instance has been reported. The results of excision for hydatid cyst are: before 1890, 5 cases with 3 deaths; 1890 to 1900, 10 cases with 1 death; 1900 to 1908, 8 cases with no death. For non-parasitic cysts there were, before 1890, 4 removals with no death; 1890 to 1900, 3 removals with no death; 1900 to 1908, 6 removals with no death.

(9) Leukæmia.—In this affection splenectomy is definitely contraindicated. There have been 48 cases with 44 deaths.

(10) Tuberculosis.—There are several cases on record where the spleen was removed with the subsequent entire recovery of the patient. The condition is hardly ever primary. Before 1890 there was 1 removal with no death; 1900 to 1908, 3 removals with no death.

(11) Sarcoma.—There have been 11 cases reported with 3 deaths.

(12) Abscess.—This condition is always secondary. Surgical treatment is always indicated; and incision and drainage is the operation of choice. There have been 9 splenectomies with 1 death.

(13) Miscellaneous conditions.—Under this head the speaker grouped 5 splenectomies for pseudoleukæmia with 1 death, 1 successful operation for infantile splenic anæmia, 4 operations for benign growths with 1 death, 1 successful removal for echinococcus cyst, and 1 excision for aneurysm of the splenic artery. Under injuries he grouped spontaneous ruptures and crushing accidents. Immediate operation is imperative after rupture: the statistics are, 67 operations with 29 deaths. If the spleen suffers a penetrating wound, operation should be performed if the injury is multiple: for such wounds there have been 13 removals with 4 deaths. The cases that include all trauma number 150 splenectomies with 51 deaths.

Of Dr. Johnston's own 6 cases, 5 terminated in recovery. The fatal case was one of leukæmia.

Discussion.

Dr. Hunner expressed the society's indebtedness to Dr. Johnston and stated that in the gynæcological service of the Johns Hopkins Hospital there have been, in 13,000 admis-

sions, 5 cases of splenectomy and 1 case of partial excision of a blood cyst of the spleen. Of the 5 cases 2 were diagnosed before operation as multilocular ovarian cystoma, especially as they were wedged in the pelvis. One case was first diagnosed myoma uteri, although the possibility of a misplaced kidney was thought of. Only two of the five cases were diagnosed. In all there was a history of malaria.

DR. CUSHING recalled having removed 2 spleens for splenic anæmia. In both cases the most marked symptom was hæmatemesis. In the first case the diagnosis was gastric ulcer: no ulcer was found, but a very large spleen was removed. In the second case, Dr. Osler thought the hæmatemesis was due to some disturbance of the gastro-splenic vessels. Although this patient gained rapidly and the wound healed, he died 2 weeks after the operation from a sudden attack of hæmatemesis. Autopsy revealed extensive oesophageal varices, but there was no lesion of the stomach.

March 16, 1908.

Meeting of the Johns Hopkins Hospital Medical Society, Dr. Norton presiding in the absence of the president, Dr. Finney.

I. The Kern-plasma Relation Theory. DR. HOWARD, Cleveland, Ohio (see 2d article in this number).

DISCUSSION.

DR. WELCH considered work along the lines discussed by Dr. Howard to be of the highest importance as possibly being able to shed light on the structure and function of cells. He thought it still doubtful whether the chromidial network in the protoplasm is to be interpreted as being of nuclear origin, although it takes the nuclear stain. If nuclei are developed in chromidin nuclear cytoplasm, the event would be of extraordinary scientific value: it would make us think of giant cells where we can see no nuclear division. Dr. Howard's studies on pigmentation, he thought, opened up very suggestive lines of work. It is likely that the pigmentation in heart muscle is of nuclear origin. These studies might apply, perhaps, to regressive processes. We are familiar with giant nuclei in degenerations, with overgrowth of nuclei in atrophied fat and in degenerated atrophied muscle fibers. They may also throw a good deal of light on many of the mysterious inclusions in cells, particularly the Plimmer bodies.

DR. HOWARD replied that he thought that Schaudinn had made a very clear case that chromidin is nuclear material. It stains exactly like it and undergoes division; not, however, mitotic division. In spore formation a certain amount of this material goes into the new spores.

II. Studies on the Circulation. DR. P. M. DAWSON, DR. R. P. HIGGINS, and MR. L. W. GORHAM.

There is good reason for supposing that under normal circumstances the pulse pressure may be regarded as an index of the systolic output. It was, however, surmised that extreme variations in the mean blood pressure might disturb the parallelism between these two phenomena. Accordingly Dawson, at first alone and later in company with Gorham, performed experiments in which the pulse pressure and the systolic output were carefully compared. The former was determined by means of the Hurthle manometer; the latter by the use of a plethysmograph. The results obtained seemed to them to justify the following conclusion: Under normal conditions and during various procedures (namely; stimulation of the vagus centrally and peripherally, of the saphenus nerve centrally and of the annulus Vieussentis, and also during intravenous infusion of NaCl 0.7 per cent, intra-arterial infusion of strong sodium carbonate, bleeding and asphyxia) the pulse pressure remains a reliable index of the output of the heart per systole.

Extensibility and elasticity should not be confused. In a perfectly elastic body each is the reciprocal of the other. The extensibility of the excised arteries is determined by applying to them a stretching force and noting the increase in length of the piece of artery under examination; the distensibility, by applying pressure to the internal surface of a closed cylinder of artery and noting the change in the volume of the cylinder. Among those who have made studies of this kind is MacWilliam, who called attention to the fact that the excised arteries exist in either the contracted or the relaxed condition and that the curves of distensibility and extensibility differ in the two cases. He found that in the relaxed artery both distensibility and extensibility diminished as the distension or stretching proceeded. In the case of the contracted artery, the distensibility showed at first an increase and then a decrease and the same was true of transverse extensibility. But in the case of longitudinal extensibility a curve similar to that of the relaxed artery was obtained.

Higgins now confirms most of MacWilliam's results but differs from him in two respects. (1) He finds that the longitudinal extension of arteries in the contracted state at first increases and then decreases; that is, the same curve is obtained as in the case of the distensibility. (2) He regards the contracted state as a form of rigor mortis while MacWilliam regards it as the normal condition of the healthy artery.

With the object of determining the conditions actually present in the living animal, Dawson and Gorham made determinations of the velocity of transmission of the pulse wave in anæsthetised dogs in which the blood pressure was simultaneously caused to vary to a considerable extent. In this way it was hoped that a definite relation would be detected between the mean pressure and the velocity of the transmission of the pulse. For, since the velocity varies with the elasticity, the relation of the distension of the vessels to the distensibility (or in other words the variations in arterial elasticity and extensibility for varying arterial pressure) might thus be determined indirectly. The experiments, however, yielded unlooked for results, for it was found that owing probably to changes in the tone and caliber of the arteries the velocity of transmission of the pulse shows variations which are often independent of the mean blood pressure (and pulse pressure); that is, of the distending force.

NOTES ON NEW BOOKS.

Obstetrics. A Text-Book for the Use of Students and Practitioners. Second edition. By J. WHITRIDGE WILLIAMS, Professor of Obstetrics, Johns Hopkins University; Obstetrician-in-chief to the Johns Hopkins Hospital, etc. With 16 plates and 666 illustrations in the text. (*New York and London: D. Appleton & Co., 1908.*)

Four years ago we took great pleasure in reviewing the first edition of this text which, on account of presentation of the pathology, the sound teaching of its extensive subject matter, its unusual bibliography, and pleasing manner of presentation was destined in our belief to be a standard text for students interested in scientific medicine. Naturally, therefore, we have awaited the appearance of the second edition with some impatience, while some other obstetrical texts of comparative age have passed through new editions, necessitated in our judgment only by a much needed revision of their faulty pathology.

We must confess that we received this new edition for review under the impression that it contained comparatively few changes. Much to our surprise, therefore, we found that practically the entire work has been revised and changed, and additions made to nearly every chapter. The subjects of the greatest interest in the obstetrical world at the present time have been entirely rewritten. Especially is this true of the chapters on the toxæmia of pregnancy, which now presents no points of resemblance to the older article. During the last few years this subject has been one of great interest to the Baltimore school, due in large measure to the brilliant and stimulating work of Slemons on the metabolism of normal and pathological pregnancies. As is well known from his recent articles, Dr. Williams would differentiate three types of pernicious vomiting of pregnancy; namely, reflex, neurotic, and toxæmic. He takes the view that the two former types can be readily cured, whereas in the latter variety the pregnancy must be terminated before organic lesions supervene which may be so pronounced as to be incompatible with recovery. Much, therefore, depends upon the differential diagnosis, which according to the author can be made only by the ammonia coefficient, which in the toxæmic variety exceeds 10 per cent. This view has evoked a flood of discussion from many who are quite incompetent to discuss the subject, as well as some who have done work in this field yet believe that undue importance is attached to a subject dependent upon as many variable factors as ammonia in the urine. Be that as it may, the fact remains that the reasons for Dr. Williams' belief are stated in the text in an extremely clear manner, and even if future work shows that the bottom of this blind subject has not been reached, the scientific world will still be under many obligations to Drs. Williams and Slemons for their stimulating work. The chapter on eclampsia is in effect a monograph as complete as could be desired.

The chapters on the development of the ovum have also been entirely rewritten, and this subject, once the despair of the medical student, now reads as an interesting novel. Waldeyer's recent investigation of the development of the ovary is taken as a basis, and the development of the fœtal membranes is considered in the light of the newer studies in the embryology of the higher mammals, which tend to substantiate the view that the amnion in man is formed as a result of the "inversion" of germ layers. These chapters, together with those of placentation, present a refreshing contrast to the usual descriptions noted in the average text.

In the discussion of the mechanism of labor, Sellheim's very recent theory is given which promises to revolutionize our former conceptions.

We note with pleasure that Dr. Williams inclines more to the necessity of actual measurements of the pelvic *canal* than in the former volume. Personally we believe that much harm has been done by teaching that much information concerning the pelvic canal can be obtained by the usual external measurements. In our opinion, actual measurements should be made in *all* cases, and the student taught that he is culpable unless the diagonal conjugate, and the anterio-posterior and transverse diameters of the outlet are taken as a routine, after the pelvis has been carefully palpated. In the present edition, Klien's work, which has added so much to our knowledge of contractions of the outlet, is considered and given the attention which it deserves.

Viewed from the practical side, many important features of the new edition are found in the chapters on the treatment of contracted pelvis. Careful reading of these articles shows that the author has modified his view as to the advisability of performing cæsarean section late in labor, as he now states that the results rapidly become worse the later it is performed, thus agreeing with the majority of American obstetricians. Yet the fundamentals of his treatment of "border line" cases remain unchanged, and are based upon the fact that upward of 60 per cent of such cases will be delivered spontaneously if they are given the opportunity, although the fœtal mortality increases so rapidly with the degree of pelvic contraction that it must be taken into consideration. Therefore, if all border line cases are subjected to primary cæsarean section, as unfortunately is the present tendency, a very large proportion of cases will be needlessly subjected to a serious operation. For these reasons the author has largely substituted pubiotomy for the cæsarean in the class of cases which he would first try by the second stage in the hope that labor may progress spontaneously, believing that the results will be less serious than by the older method. The statistics which he adduces are favorable to pubiotomy, although since these chapters went to press other less favorable reports have appeared in the literature. As yet the author has found no use for the induction of labor in this class of cases, which we believe has a most valuable field.

So much discussion has arisen in this country concerning certain phases of the treatment formerly advised in this text for this class of cases, that we can not refrain from certain comments. Although we are friendly neither to the late cæsarean, nor to pubiotomy as elective measures, it does appear to us that the numerous opponents of the expectant plan of treatment advocated by the author have evaded a fundamental point, as it does not follow that the total mortality of cases of labor in contracted pelvis will be more in the expectant than in the elective plan of treatment, even though it is granted that the mortality of cæsareans during the second stage greatly exceeds that of those performed before the onset of labor. Fewer cases will be subjected to serious major operations in the expectant than in the elective plan, and therefore it is just as useless to compare the results of cæsareans during the second stage of labor with those before the onset, as to compare the ultimate results of cervical cancer in the services of men who operate upon only 10 per cent of cases with those who treat a much larger number. The fact that Dr. Williams would substitute pubiotomy for the late cæsareans does not alter the fact that he is encouraging conservative treatment by selecting cases, which would be even more conservative if the premature induction of labor were advised in proper cases. The truth as to the best way of treating labors in contracted pelvis can be ascertained eventually only by the comparison of large series which include *all* the cases of contracted pelvis treated in various clinics, divided into groups according to the method in which delivery was effected, together with their maternal and fœtal mortality.

The text indicates that the author would wisely restrict the employment of accouchment forcé, advising vaginal hysterotomy

in its stead for rapidly terminating pregnancy when indicated, in all cases in which the cervix is undilated and rigid.

In all other sections is the work also brought up to date, the additions necessitating an increase in the number of illustrations, plates and pages.

This volume has been most difficult to review, largely due to the fact that the most important chapters are in effect monographs, which constantly tempt one to discuss them from that standpoint, and make him forgetful that the work is designed for students and practitioners rather than teachers. Yet from any standpoint the edition is a distinct and valuable contribution to medical science, combining as it does safe teaching and scientific accuracy with a rare literary style. FRANK W. LYNCH.

First and Second Interim Reports of the Royal Commission appointed to Inquire into the Relations of Human and Animal Tuberculosis. (London: Printed for His Majesty's Stationery Office, by Wyman & Sons, Limited, Fetter Lane, E. C. 1904-1907.)

Following Professor Robert Koch's famous address before The British Congress on Tuberculosis on July 23, 1901, the King of England appointed on the 31st day of August, 1901, a Royal Commission consisting of Sir Michael Foster, Dr. German Sims Woodhead, Dr. Sidney Harris Cox Martin, Prof. John McFadyean and Prof. Rubert William Boyce to inquire and report with respect to tuberculosis: 1. Whether the disease in animals and man is one and the same; 2. Whether animals and man can be reciprocally infected with it; 3. Under what conditions, if at all, the transmission of the disease from animals to man takes place, and what are the circumstances favorable or unfavorable to such transmission.

This commission thus appointed immediately prepared to consider an answer to these questions by making a series of experiments upon animals, and through the generosity of Sir James Blyth was placed in control of two farms with farm buildings and other accommodations for the investigation of the problems at Stansted about half way between London and Cambridge.

On the 16th of May, 1904, the commission made its first interim report, a little pamphlet of four leaves without cover. In this report, the commission says: "The results which we have thus obtained are so striking, that we feel it our duty to make them known, without further delay, ... for the reason that the result at which we have arrived; namely, that tubercle of human origin can give rise in the bovine animal to tuberculosis identical with ordinary bovine tuberculosis, seems to us to show quite clearly that it would be most unwise to frame or modify legislative measures in accordance with the view that human and bovine tubercle bacilli are specifically different from each other, and that the disease caused by the one is a wholly different thing from the disease caused by the other."

Following up the line of work already begun and thus reported upon in the First Interim Report, in January, 1907, the commission issued its Second Interim Report with a detailed statement of all the investigations completed up to that date. The whole comprises six full quarto volumes consisting of about 2600 pages. The care and accuracy with which the details of each line of investigation have been made make the report well worthy of the highest consideration.

The work upon the Pathogenic Effects of Bovine Viruses has been done mainly by Dr. A. Stanley Griffith. The work upon the Pathogenic Effects of Human Viruses by Dr. Louis Cobbett. The volume on the "Comparative Histological and Bacteriological Investigations," by Dr. Arthur Eastwood.

A few quotations as to the bearings of the results arrived at will be interesting, and these conclusions are based not only upon the most careful observations of the men whose names have just been quoted, but have been carefully investigated in every instance by the commission itself, and, therefore, are entitled to great weight. The report says:

"There can be no doubt but that in a certain number of cases the tuberculosis occurring in the human subject, especially in children, is the direct result of the introduction into the human body of the bacillus of bovine tuberculosis; and there also can be no doubt that in the majority at least of these cases the bacillus is introduced through cows' milk. Cows' milk containing bovine tubercle bacilli is clearly a cause of tuberculosis and of fatal tuberculosis in man.

"Of the 60 cases of human tuberculosis investigated by us, 14 of the viruses belonged to Group 1, that is to say, contained the bovine bacillus. If, instead of taking all these 60 cases, we confine ourselves to cases of tuberculosis in which the bacilli were apparently introduced into the body by way of the alimentary canal, the proportion of Group 1 becomes very much larger. Of the total 60 cases investigated by us, 28 possessed clinical histories indicating that in them the bacillus was introduced through the alimentary canal. Of these 13 belong to Group 1 (*i. e.*, contained the bovine bacillus). Of the nine cases in which cervical glands were studied by us, three, and of the 19 cases in which the lesions of abdominal tuberculosis were studied by us, 10 belong to Group 1 (*i. e.*, contained the bovine bacillus).

"These facts indicate that a very large proportion of tuberculosis contracted by ingestion is due to tubercle bacilli of bovine source.

"A very considerable amount of disease and loss of life, especially among the young, must be attributed to the consumption of cows' milk containing tubercle bacilli. The presence of tubercle bacilli in cows' milk can be detected, though with some difficulty, if the proper means be adopted, and such milk ought never to be used. There is far less difficulty in recognizing clinically that a cow is distinctly suffering from tuberculosis, in which case she may be yielding tuberculous milk. The milk coming from such a cow ought not to form part of human food, and indeed ought not to be used as food at all.

"Our results clearly point to the necessity of measures more stringent than those at present enforced being taken to prevent the sale or the consumption of such milk."

Such conclusions as these, reached after such careful and comprehensive investigations as the report indicates, must command our respectful attention and warn us to remit in no degree our efforts to secure milk, especially for infants, from cows proven by the tuberculin test to be free of tuberculosis. H. B. J.

Thirty-fifth Annual Report of the Local Government Board, 1905-1906. Supplement in the Continuation of the Report of the Medical Officer for 1905-1906. "On Sanatoria for Consumption and Certain Other Aspects of the Tuberculosis Question." By H. TIMBRELL BULSTRODE, M. D. Price 10s. 2d. *(London: Printed for His Majesty's Stationery Office, by Darling & Son, Ltd., 34-40 Bacon St., E., 1908.)*

Attention is called to this comprehensive report of the tuberculosis question in Great Britain, a volume of 670 pages. No work which has recently appeared gives such a complete idea of the condition of the tuberculosis problem in any country as does this of Dr. Bulstrode's. The extent of the study may be gathered from the titles of certain of its chapters. Chapter II—"The Decline in the Death Rate of Pulmonary Tuberculosis in England." Chapter V—"The Prevalence of Tuberculosis in the Human Subject and the Evidence which such Prevalence affords of the Curability of the Disease." Chapter VII—"The Influence of Earlier Recognition and Better Treatment upon the Death Rate of the Malady." Chapter VIII—"The Evolution of the Sanatorium Idea." Chapter XII—"Immediate Results of Sanatorium Treatment."

Extremely interesting is Chapter II with its table showing the

steady decrease in the death rate from tuberculosis since the year 1853, a decline not much increased or altered apparently by the discovery of the tubercle bacillus, or the modern methods of prevention; a decline, too, if it were to persist in future years at the same rate would seem to indicate that within the memory of men now living tuberculosis would cease to be a factor in the death rate of Great Britain.

The latter part of the book is devoted particularly to the description of the sanatoria of the British Isles, and gives both by pictures and by full statements a very accurate idea of the kind of work being done in each one of them. England, particularly in the last two or three years, has had a very large increase in the number of its sanatoria, and as their statistics compare very favorably with the statistics in the sanatoria, which in earlier years were considered to be in the necessary climate, this report goes far toward disproving the value of climate per se as a factor in the curability of tuberculosis.

This report should have wide reading in this country as it represents the best type of work upon the subjects discussed.

H. B. J.

Diets in Tuberculosis, Principles and Economics. By NOEL DEAN BARDSWELL, M. D., etc., and JOHN ELLIS CHAPMAN, M. R. C. S., etc. (*London: Henry Frowde*, and *Hodder & Stoughton.*) *Oxford Medical Publications.*

There has been of late years a general reaction against forced feeding in tuberculosis and a more reasonable groundwork sought for in prescribing diets to tuberculous patients. Bardswell and Chapman have contributed interesting observations to the question, and in their present publication have collected their previous work, and put it into a concise and instructive form. The book is plainly and interestingly written, and as it is not at all technical, it will prove of as great value to visiting nurses and social workers as to physicians. There is no problem these meet more important than the instruction of the poor in the most economical food they can buy and the most advantageous way they can prepare it. The object of the authors is to construct a standard diet that will be clinically efficient, that will be palatable and that will be economical. They accept as a normal physiological diet one that contains for each day 120 grammes of proteid and from 2500 to 5000 calories depending upon the amount of muscular work done. For a tuberculous patient the amount of proteid and the number of calories should be raised by about a third above what would be for them a normal diet. Their gain in weight and the clinical progress of their disease is then quite satisfactory and they are saved the digestive disturbances which are frequently so very distressing when forced feeding is practiced. An economical diet the authors conclude from studies of normal workingmen's diets, should not cost over 1 shilling, or 25 cents per day. They give a lengthy consideration of the cost and nutritive value of various articles of food and an interesting report upon the relative efficiency of animal and vegetable proteid. They were able to treat quite successfully early cases of pulmonary tuberculosis when the patients could take considerable exercise with absolutely meat-free diets. Advanced cases with fever and at rest must have their meals in a more concentrated form as their impaired digestion cannot cope with the large bulk of food it is necessary to take to get the required amount of proteid from vegetables. In the last chapter a diet table is given which was used in the Coppin's Green Sanitarium and which may be considered a standard. It contains 153.3 grammes of proteid and 3889 calories; its cost is 11.57 pence, or about 24 cents per patient per day; each cent buys 6.4 grammes of proteid and 162 calories; the diet is clinically efficient as the progress of the patients was most satisfactory. The book is liberally supplied with tables which make the information compact and are not so filled with detail as to be a task to unravel.

A Mind That Found Itself—An Autobiography. By CLIFFORD WHITTINGHAM BEERS. (*New York: Longmans, Green & Co., 1908.*)

The value of this work can be estimated justly by a few trained psychiatrists only, and for that reason it is regrettable that it should be read by the public at large. It is right that the public should be informed of all that Mr. Beers tells it, but the public will hesitate to believe that Mr. Beers' autobiography is credible. Mr. Beers was insane, and passed several years in both private and State hospitals for the insane in Connecticut. Of the years passed in these institutions, and what he saw, and how he suffered in them he has written fully, and by the student of mental disease this autobiography will be read with care. Mr. Beers has written the book with the purpose of arousing national interest in these asylums, and of effecting reforms in their internal administration. Many should doubtless be wiped off the face of the earth—they are horrible and a disgrace to our civilization—others, like all human institutions, could be improved, and a few are as nearly perfect as intelligence and kind-heartedness can make them. It would be a pity if the public were to get overexcited on this question—reforms cannot be accomplished of a sudden, and there is no doubt that each year sees improvements in the care of the mentally ill. It would be well if there was more State supervision of all institutions where this class of patients is cared for, but all know how evil State supervision often is where appointments are made for political reasons rather than on the ground of knowledge and capacity. Other similar autobiographies have been written, and the care of the insane has for years been discussed in our legislative bodies, and their care is, on the whole, as good as that of other dependent and irresponsible persons. Their care cannot be better than the intelligence of the communities in which they live accounts for. It is not simply either a question of intelligence, but one of finances. Many of those in charge of the insane are ignorant, many have not and cannot secure the means to carry out reforms they see the need of. Mr. Beers is to be praised for his frankness—it must have been even more painful to him to write his autobiography than it is for us to read it—and if he succeeds in securing any needed reform, the public will be most grateful to him, and hail him as a hero. Meanwhile, may the book be read only by the serious-minded, and not by those in search of a new sensation, no matter at what cost. It is most painful to think of any one reading this sorrowful revelation of a man's most intimate life, which most would desire to hide from all eyes, for mere amusement. For this reason it is desirable that the book should not have too wide a circulation, for much of it will be falsely interpreted, as it can only be understood by doctors, and therefore should only be in their hands. If it can assist in the establishment of psychopathic hospitals wherein patients can be treated and cured as in a general hospital, it will have accomplished great good.

R. N.

Diseases of the Breast with Special Reference to Cancer. By WILLIAM L. RODMAN, M. D., LL. D., Professor of Surgery in the Medico-Chirurgical College of Philadelphia, Professor of Surgery in the Womans Medical College of Pennsylvania, etc. With 69 plates, of which 12 are in colors, and 42 other illustrations. $4.00. (*Philadelphia: P. Blakiston's Son & Co., 1908.*)

In the first 172 pages the anatomy and the various diseases of the breast are briefly discussed, while the last 208 pages are taken up with the consideration of carcinoma. It is to be noted that Halsted's operation for cancer of the breast is not described among the others, although it is the one most frequently used, and, furthermore, is the original complete breast operation, and has been used by him as a routine measure since 1888.

Many authors are quoted throughout the book, but references to their original articles are few and far between.

The illustrations are good, although we have seen many of them before in the journals of the last few years.

There is little that is new or original in this treatise, which, on the whole, is quite superficial in its character, and practically nothing is added to the previous knowledge of diseases of the breast.

Life Insurance and General Practice. By E. M. BROCKBANK, M. D., etc. (*London: Henry Frowde, Hodder & Stoughton, 1908.*) *Oxford Medical Publications.*

This is an excellent manual for practitioners who are examiners of life insurance companies. Examinations made with the object of insuring lives require more than ordinary care and knowledge on the part of the doctor, who has oftentimes an extremely difficult rôle to play. In addition to the power of making a careful physical examination, the examiner must have the ability to look ahead, and weigh the chances of the probable duration of life of the applicant—no easy task oftentimes. He has rules to guide him, but, as is frequently said, rules are made to be broken, and he must know when he can do this with safety to the company for whom he is examiner, and with advantage to the proposer, the person insuring his or her life. Dr. Brockbank has divided his manual into two sections: 1st. The Medical Examination of an Applicant for Insurance; 2d. Impaired lives. Such a division necessarily involves a certain amount of repetition, but, on the whole, is a satisfactory manner of dealing with the subject of life insurance. The insuring of "impaired" lives is to-day one of the most important and difficult parts of life insurance work. A few years ago "impaired" lives were not accepted by most companies, but to-day only a few companies still refuse to accept these lives on some plan. The studies of risks have been many, and as a result many more lives more or less impaired can be safely accepted than heretofore. This is an immense advantage to the applicant, and it is by this liberality that the American companies have gone ahead with such strides. The meetings of insurance examiners both at home and abroad have brought about a better understanding of "risks" of all natures, and to-day there is a well-marked tendency on the part of almost all companies to accept all applicants who have at least a fair probability of, say, 10 years' life on some plan. The plan may be costly to the applicant, but it at least gives him a chance to insure himself if he so desires. Insurance for a healthy life for a limit of 10 years is expensive, so that for an impaired life it is still more so, but there are always some who are willing to pay the increased rates, and the rates for almost all classes and ages is diminishing. Dr. Brockbank's work can be recommended as a safe and reliable guide to all examiners of life insurance companies, and it will help them over many of the difficulties of their work. It is only to be wished that he had added a chapter on the relation of doctor and agent, and one on frauds, both important features in this branch of medicine. R. N.

Treatment of Internal Diseases, for Physicians and Students. By DR. NORBERT ORTNER, of the University of Vienna. Edited by NATHANIEL BOWDITCH POTTER, M. D., etc. Translated by FREDERIC H. BARTLETT, M. D. (*Philadelphia and London: J. B. Lippincott Company, 1908.*)

This volume, devoted to the treatment of internal diseases, will, we believe, prove a disappointment to American readers. As the editor remarks in his preface, "the profusion of prescriptions and the author's apparently perfect trust in so many drugs" is disappointing, and may prove, for the beginner at least, a source of considerable difficulty. Much of the text is excellent, but one is constantly struck with the overemphasis of the drug treatment, often to the neglect of simple but equally or more important hygienic measures.

It is gratifying to find only surgical treatment of gastric carcinoma discussed, emphasis being laid on the importance of early diagnosis, while the medical treatment which follows is solely for inoperable cases. The author's experience with the surgical treatment of exophthalmic goiter does not coincide with the results obtained in the clinics of the most skilled American and European surgeons. The treatment of pernicious anæmia is surprisingly poor; arsenic is warmly recommended and transfusions of blood are said to be beneficial, though the author admits that in only two instances has he seen benefit derived from this procedure—and in both instances the patients were suffering from *secondary anæmia.* No reference is made to the value of rest in bed, fresh air, sunshine, etc.

Many valuable additions to the text have been made by the editor, but despite these the volume is not one which we feel should be recommended.

Abel's Laboratory Handbook of Bacteriology. Translated from the tenth German edition. By M. H. GORDON, M. D., etc. With additions by Dr. A. C. HOUSTON, DR. T. J. HORDER, and the Translator. Price, $1.50. (*London: Henry Frowde,* and *Hodder & Stoughton, 1907.*) *Oxford Medical Publications.*

The 10th edition of Abel's well-known book on bacteriological technique has been much enlarged and improved by the translator, M. H. Gordon, assisted by A. C. Houston and T. J. Horder. It contains clear, simple descriptions of the standard methods employed in bacteriology and can be heartily recommended to students as a convenient laboratory guide. Section XI, by Houston, is devoted especially to the consideration of the bacteriological examination of water, milk, shell-fish, etc., and is an important addition to the original, likely to prove of great service to students of sanitary bacteriology.

Atlas and Text-Book of Human Anatomy. Volume III—Completing the work. By Prof. J. SOBOTTA, of Wurzburg. Edited, with additions, by J. PLAYFAIR MCMURRICH, A. M., Ph. D., Professor of Anatomy at the University of Toronto, Canada. Quarto of 342 pages, containing 297 illustrations, mostly all in colors. Cloth, $6.00. (*Philadelphia and London: W. B. Saunders Company, 1907.*)

Volume III, Vascular System, Nerves, and Sense Organs, the last of the publication, proves a worthy successor of the two which have preceded it.

The illustrations, as in the former volumes, are realistic, and have lost nothing from the fact that the vessels and nerves appear, as in the subject, depicted together, though at times the vast amount of detail has led to unavoidable transposition of names, *e. g.*, on page 85, Fig. 588, left subclavian artery should read vein, and minor mistakes in letters, which the student will discover for himself.

The effort to emphasize the collateral circulation deserves special mention, even though it is at times diagrammatic; it is a great aid to the memory to realize through the picture the mechanism of this important provision in nature.

The minute detail of the lymphatic system is well worth particular attention, as that system is usually neglected by the average student, through the necessarily limited supply of material, and the apparently unimportant position of the system in minor surgery.

The nervous system and the eye and ear receive generous consideration, and by a series of really exquisite plates, these intricate organs are presented in a comprehensive way.

As before said, a review cannot do justice to this publication.

On page 125, fourth line from the top *fine* should read *find.*

Diagnostics of the Diseases of Children. By LE GRAND KERR, M. D. Cloth, $5.00. 542 pages with illustrations. (*Philadelphia: W. B. Saunders Company, 1907.*)

The subject of exact diagnosis has been attracting more attention of recent years than ever before, and this book is an effort to bring into one volume the numerous facts which relate to the diagnosis of disease in infants and children. It is a book which is much needed by the general practitioner and by others who have to do with children. It gives a thorough resumé of the methods of examination, as well as short accounts of the significance of various symptoms and of the more important diseases. It contains a number of original illustrations, and taken altogether should prove a very useful addition to any library. The publishers have done their part of the work well with the exception that the book is printed on very heavy paper which makes it larger and heavier than necessary.

American Practice of Surgery. Editors, JOSEPH D. BRYANT, M. D., LL. D.; ALBERT A. BUCK, M. D., of New York City. Complete in eight volumes. Profusely illustrated. Volume IV. (*New York: William Wood & Co., 1908.*)

In this volume the part on diseases and injuries of joints is concluded, and Parts 14 and 15 on operative surgery and orthopedic surgery complete the volume. The contributors are all men well known in the profession. It would seem more natural if in such a practice of surgery the part on operative surgery had been in the first volume, and it is a pity that parts are divided so as to appear in successive volumes. The work is, as stated, profusely illustrated, and as a result over-illustrated, but the quality of the illustrations is in large measure excellent. For the surgeons—the country practitioners—who are called upon to perform all sorts of operations and who have not the opportunity to see them constantly performed in the large cities by the most skilled operators, this system will prove serviceable, as it is full of detail. But a man will never become a skilful surgeon from reading any system of surgery—he must either be born with certain natural gifts or have the chance to practice surgery largely—so that it is doubtful how valuable such a system as the present one is, as the country practitioner had better operate only in emergency cases, and not be induced to do difficult operations, by the apparent simplicity of a picture and book description. This "Practice" can be safely recommended to all who can afford its purchase, for it is a useful and excellent guide. R. N.

A Practical Guide to the Examination of the Ear. By SELDEN SPENCER, A. B., M. D. With an introductory chapter by H. N. SPENCER, M. D., LL. D. 12 mo. 66 pages. (*St. Louis: C. V. Mosby Medical Book Publishing Company, 1908.*)

This little book is of an unusual character, purporting merely to present an outline sketch of the course in otology as it should be pursued by the undergraduate medical student. It points out briefly the methods of procedure in making aural examinations and suggests the points of practical importance in the study of the diseases affecting different portions of the organ. Several good and useful illustrations of the tympanic membrane and cavity are presented. H. O. R.

Burdett's Hospital and Charities, 1908. Being the Year Book of Philanthropy and the Hospital Annual. By Sir HENRY BURDETT, K. C. B., etc. Price 7/6 net. (*London: The Scientific Press, Limited.*)

Sir Henry Burdett's Annual has long been known and much appreciated by all interested in hospital administration. No one else has devoted so much time and study to all parts of this work, and his ability has been universally recognized. The volume grows in size annually and shows an immense amount of painstaking labor and industry in the compiling of numerous valuable tables. All administrative officers of hospitals owe him a deep debt of gratitude for his toil and efforts, which have brought about many much needed and important reforms in hospital government. In addition to the tables which appear annually in this volume, there are several short papers, which, though applying more especially to conditions existing in English hospitals, are nevertheless worth study in relation to American hospitals. A similar volume for the United States and Canada would be most serviceable, and it is to be hoped that before long some one may be willing to undertake this burdensome task, which has little recompense, except the personal satisfaction which comes from doing a tedious piece of work well. R. N.

Medical Gynecology. By HOWARD A. KELLY, M. D., etc. 8vo. 662 pp. 163 illustrations. (*New York: Appleton, 1908.*)

In this work Dr. Kelly has, with the assistance of several colleagues and members of his staff, presented very fully those phases of gynecological practice which come within the scope of the general practitioner. The subjects of hygiene and prophylaxis are most carefully considered, and these chapters must prove specially valuable to those who have the care of growing girls and young women.

Diagnosis is presented very clearly, and it is here particularly that the admirable drawings by Messrs. Brödel and Horn are of the greatest value, supplementing and making clear what the most careful description leaves indistinct and confusing to one not specially trained in this field.

Dr. Barker contributes an excellent chapter on the functional nervous diseases met with by the gynecologist which fills a place hitherto rather neglected by the authors of text-books in this branch of surgery.

The venereal infections are handled very broadly, and the important questions as to marriage, heredity, and sterility carefully considered.

Treatment is given a large share of consideration, and all the modern methods of mechanical and electric therapy are brought to bear as well as the best of the old and new in drug treatment.

Altogether the book is a very acceptable addition to the working library of the physician and student. T. R. B.

International Clinics. Vol. I. 18th series. 1908. (*J. B. Lippincott Company, 1908.*)

In addition to the usual number of papers, 19 in number, in this volume, on treatment, medicine, surgery, gynecology, neurology, and pathology, there are three long reviews on the "Progress of Medicine During 1907." The first of these is on "Treatment," by Dr. A. A. Stevens; the second on "Medicine," by Drs. D. L. Edsall and V. Nesbet, and the third on "Surgery," by Dr. J. C. Bloodgood. The latter covers 50 pages, while the two other demand only about 30 each. It is doubtful, however, whether any fair estimate of the real progress in these branches could be drawn from these figures, but it is fair to state that to the general practitioner, the yearly advances in surgery are more apparent than those in medicine. The volume does not fall behind its predecessors in general interest—it contains various timely articles written by well-known men, and is abundantly illustrated. R. N.

An Aid to Materia Medica. By ROBERT H. M. DAWBARN, M. D., etc. Fourth edition, revised and enlarged by EDEN V. DELPHEY, M. D. Price, $1.75. (*New York: The Macmillan Company, 1908.*)

This small volume is one of the best of its kind that we have seen. It is intended solely for those preparing for examinations and for physicians for quick reference. The text has been revised to conform with the recent edition of the pharmacopeia. Perhaps the best part of the book is the preface, in which the author gives

some very wholesome advice. We quote the following: "The writer, however, after 27 years as a physician, finds himself using a very limited range of drugs and believes it would be the part of wisdom for physicians to drop many which they are now using, to get thoroughly acquainted with a few drugs and not change to a new or much-lauded drug until he finds an indication which the old one fails to meet."

Medical Lectures and Aphorisms. By SAMUEL GEE, M. D., F. R. C. P., etc. (*London: Henry Frowde, and Hodder & Stoughton, 1908.*) *Oxford Medical Publications.*

This little volume of lectures, now in its third edition, well deserves the popularity it has attained. The essays are delightfully written and are teeming with clinical wisdom, the result of the author's long experience in hospital and private practice. No one essay can be singled out for commendation, they are all so good. One's only regret in reading this volume is that it is not larger. The aphorisms are for the most part well-known clinical facts and are well chosen.

Dr. Gee's work cannot be too highly recommended, we feel. The physician who reads it will be likely to be entertained as well as instructed.

The Animal Mind. A Text-Book of Comparative Psychology. By MARGARET FLOY WASHBURN, Associate Professor of Philosophy in Vassar College. 8vo. Cloth. 333 pp. Price, $1.60 net. (*New York: Macmillan, 1908.*)

This work is the second volume in The Animal Behavior Series, recently inaugurated with the publication of Yerkes' "Dancing Mouse." In the present work, the author sums up what is known concerning the neural and mental manifestations in the so-called lower animals, "as deduced from experimental evidence." The matter is considered from the standpoint of comparative rather than genetic psychology, and makes readily accessible a mass of scattered material which has been accumulating in a new, most difficult, and most important field of investigation.

The crux in animal psychology is the phenomenon of consciousness. The author refutes the argument of those who would limit this quality to human beings, and shows also the fallacy committed by certain observers who seek to establish definite criteria which shall make it possible to draw a line between animals with mind and those without, constantly taking account, however, of the dangers of the *psychologists' fallacy.* "We know not when consciousness begins in the animal world. We know where it surely resides—in ourselves; we know where it exists beyond a reasonable doubt—in those animals of structure resembling ours which rapidly adapt themselves to the lessons of experience. Beyond this point, for all we know, it may exist in simpler and simpler forms, until we reach the very lowest of living beings."

The author discusses in order the various sensory discriminations, space perception, habit, memory, and attention, beginning in each case with the lowest animals and tracing analogous qualities through the ascending scale, in so far as the experimental method has hitherto supplied evidence.

The bibliography contains a list of 476 works, and the fact that only about 15 per cent of these appeared previous to 1890, indicates the great activity in comparative psychology which recent years have witnessed.

In general make-up the book is satisfactory. FARRAR.

Rotunda Midwifery for Nurses and Midwives. By G. T. WRENCH, M. D. (*London: Henry Frowde, and Hodder & Stoughton, 1908.*) *Oxford Medical Publications.*

As the author states in his preface, the average nurse or midwife has difficulty in understanding the manuals provided for her. On this account he has endeavored to produce a book which shall embrace the essentials in midwifery, but in such language as to be intelligible to all, therefore he has used as few technical terms as possible, and where these are necessary, their derivation and definition is clearly given.

The book is based on the method of teaching midwifery at the Rotunda Hospital and is made to conform to the requirements of the Central Midwifery Board of England.

On the whole, the arrangement and mode of treating the subject is good; this is especially true in regard to the advice given for the recognition of abnormalities and the necessity of obtaining medical assistance in such cases.

For the beginner in the study of obstetrics this book should be quite useful.

BOOKS RECEIVED.

Medical Gynecology. By Howard A. Kelly, A. B., M. D., LL. D., F. R. C. S. (Hon. Edinb.). With 163 illustrations, for the most part by Max Broedel and A. Horn. 1908. 8vo. 662 pages. D. Appleton & Co., New York and London.

Coming Motherhood. Practical Suggestions Relating to Maternity and the Care of Infants and Children. By Louis A. Spaeth, M. D. 1907. 12mo. 93 pages. Peter Reilly, Philadelphia.

Diets in Tuberculosis. Principles and Economics. By Noel Dean Bardswell, M. D., M. R. C. P., F. R. S. (Edin.) and John Ellis Chapman, M. R. C. S., L. R. C. P. 1908. 12mo. 184 pages. Henry Frowde, London; Hodder & Stoughton, London. *Oxford Medical Publications.*

Cancer. Relief of Pain and Possible Cure. By Skene Keith, M. B., F. R. C. S., Ed., and George E. Keith, M. B., C. M. 1908. 12mo. 155 pages. The Macmillan Company, New York.

Diseases of the Heart and Aorta. By Thomas E. Satterthwaite, M. D. 1905. 8vo. 304 pages. E. R. Pelton, New York City.

American Practice of Surgery. A Complete System of the Science and Art of Surgery, by Representative Surgeons of the United States and Canada. Editors: Joseph D. Bryant, M. D., LL. D.; Albert Buck, M. D. Complete in eight volumes. Profusely illustrated. Volume IV. 1908. 4vo. 1010 pages. William Wood & Co., New York.

Board of Health of the State of New Jersey. Thirty-first annual report and annual report of the Bureau of Vital Statistics. 1907. 8vo. 432 pages. 1908. Trenton, New Jersey.

Hernia, Its Cause and Treatment. By R. W. Murray, F. R. C. S. 1908. 8vo. 99 pages. J. and A. Churchill, London.

The Border-Land of Epilepsy. Faints, Vagal Attacks, Vertigo, Migraine, Sleep Symptoms, and Their Treatment. By Sir William R. Gowers, M. D., F. R. C. P., F. R. S. 1907. 8vo. 121 pages. P. Blakiston's Son & Co., Philadelphia.

A Mind That Found Itself. An Autobiography. By Clifford Whittingham Beers. 1908. 8vo. 363 pages. Longmans, Green & Co., New York, London, Bombay, and Calcutta.

Glimpses of Medical Europe. By Ralph L. Thompson, M. D. Illustrated from photographs and from drawings by Tom Jones. 1908. 8vo. 236 pages. J. B. Lippincott Company, Philadelphia and London.

Nursing the Insane. By Clara Barrus, M. D. 1908. 8vo. 409 pages. The Macmillan Company, New York.

An Aid to Materia Medica. By Robert H. M. Dawbarn, M. D. Fourth edition, revised and enlarged by Eden V. Delphey, M. D. 1908. 16mo. 338 pages. The Macmillan Company, New York. Macmillan & Co., Ltd., London.

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